Lumsden Point General Cargo Facility

Referral Supporting Document

301012-01660 – EN-REP-01

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Level 7, QV1 Building,
250 St. Georges Terrace
Perth WA 6000
Australia
Telephone: +61 8 9278 8111
Facsimile: +61 8 9278 8110
www.worleyparsons.com
ABN 61 001 279 812

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PROJECT 301012-01660 - LUMSDEN POINT GENERAL CARGO FACILITY

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EXECUTIVE SUMMARY

The Port Hedland Port Authority (PHPA) is seeking approval under the *Environmental Protection Act 1986* (EP Act) (Western Australia) to develop the Lumsden Point General Cargo Facility. The facility would alleviate trade growth pressures on PHPA Berths 1, 2, and 3 and accommodate potential marine supply trades supporting the offshore oil and gas and other industries.

The Lumsden Point General Cargo Facility is located at Lumsden Point, which is situated at the junction of South East Creek and South Creek within the inner harbor of Port Hedland (Figure 1). It is located approximately 5 km south of the Port Hedland town site and adjoins the existing light industrial area of Wedgefield.

The proposed works will include:

- two Handymax berths totaling a length of 500 metres (m);
- dredging of up to -13.5 m chart datum (CD) for the berth pocket;
- dredging of up to -12 m CD for the access channel;
- an area of land immediately backing a wharf behind the two berth areas;
- causeway access from land-based facilities to the wharf area, and
- disposal of dredge material onshore to an approved Dredge Material Management Area (DMMA).

The site was selected consistent with the Port Hedland Ultimate Development Plan. A number of alternative layouts were considered, however the final design was developed in consultation with the Department of Commerce (DoC), the lead agency for the proposed Pilbara Fabrication and Services Common Use Facility, a future proposal adjacent to the Lumsden Point General Cargo Facility. The final design option accommodates the requirements of both the PHPA and the DoC to ensure a coordinated approach to planning that maximises the economic development opportunities in the Pilbara.

The proposal also aligns closely with the Town of Port Hedland and Landcorp's vision for the Wedgefield light industrial area to become an international freight hub closely linked to the nearby international airport.

This document provides information for determining the key impacts predicted as a consequence of implementing the Lumsden Point General Cargo Facility and proposed management and monitoring to mitigate those predicted impacts. All other minor impacts have been included in the referral application form submitted to the Office of the Environmental Protection Authority (OEPA).

Preparation of the submission is based on information from a number of developments, both proposed and recently constructed within the inner harbor of Port Hedland. Following a review of relevant projects and their corresponding EPA assessments (where applicable), it was identified that the two key environmental factors associated with the Lumsden Point

General Cargo Facility project are marine water quality and benthic primary producer habitat (BPPH).

Water Quality

The Lumsden Point General Cargo Facility will cause an increase in turbidity outside of the disturbance footprint during dredging. Sediment plume modelling has identified that the worst case for increased suspended sediment concentrations (SSC) is during winter. During winter, SSC will range between 40 and 200 mg/L for 20% of the time (80th percentile). For 50% of the time (50th percentile) SSC will range between 20 mg/L and 100 mg/L. South East Creek will experience the highest SSC during this dredging program.

Sediment plume modelling also showed that sedimentation rates during dredging will increase. On the completion of dredging, sedimentation thickness levels will range between 2 mm and 200 mm. The maximum levels of sedimentation predicted outside the dredge footprint are observed within the main channel and South East Creek, with thicknesses ranging between 2 mm and 75 mm.

The proposal to dredge 2Mm^3 of sediment from the inner harbor is one of the smaller capital dredging projects undertaken inside Port Hedland in recent times. The knowledge and experience obtained from previous water quality monitoring programs suggests that the Lumsden Point General Cargo Facility is unlikely to result in any significant impacts on water quality.

Benthic Primary Producer Habitat

Benthic habitat mapping undertaken within the Lumsden Point General Cargo Facility footprint identified that the following BPPH will be lost:

- mangrove – up to 13.88 ha; and
- bare substrate – up to 8.34 ha

The BPPH that will be directly impacted by the Lumsden Point General Cargo Facility are not considered unusual, unique or significant habitat complexes. The direct loss of BPPH for this project also represents a very small fraction of the current total BPPH found in Port Hedland and therefore the ecological significance of the estimated benthic community losses are considered manageable. The PHPA also has an ongoing mangrove rehabilitation program that plans to lower the cumulative loss within the LAU over time. In addition, the LAU mangrove communities are accreting and if net loss of mangrove communities was used rather than gross loss, it would represent around 5% mangrove loss instead (WorleyParsons 2010e). This indicates a far lower ecological impact to the ecosystem when compared with the 14.57% calculated for gross mangrove habitat loss within the LAU as a result of this proposal and potential future proposals by others.

No BPPH is predicted to be lost outside of the Lumsden Point General Cargo Facility footprint from indirect impacts. An assessment of predicted underwater light levels during dredging was undertaken. Altered light regimes due to dredging activities at key BPPH sites within the inner harbour were calculated to be similar in relation to previously encountered light regimes both at background levels and from previous dredging campaigns. The areas where light levels will be substantially reduced – within Stingray Creek and South East Creek – show

that background light levels are naturally low. Previous benthic monitoring from larger scale projects has also confirmed the natural resilience of the BPPH inside the harbour to low light and naturally high turbidity.

Considering BPPH communities have survived such low levels of light for previous much larger dredging projects (that also affected much larger areas) there is a high degree of confidence that the Lumsden Point General Cargo Facility will not result in significant impacts to BPPH. The 20 week dredging campaign is also much shorter than previous dredging campaigns providing additional assurance that the Lumsden Point General Cargo Facility will have limited potential to impact on BPPH.

An increase in sedimentation as turbid plumes migrate from the point of disturbance can occur in areas that experience reduced current flow as sediments fall out of suspension. An increase in sedimentation can cause impacts to BPPH outside of the Lumsden Point General Cargo Facility disturbance footprint due to smothering. In areas of mangroves, increases in sedimentation can cause smothering of pneumatophores which can cause a decline in mangrove health. Based on previous studies, mangroves found within the inner harbour are likely to be able to tolerate an increase in sediment thickness of 100 mm. As the modeling indicates no mangroves are likely to experience this level of sedimentation, no impact is anticipated.

Sedimentation levels experienced by other BPPs (e.g. coral, macroalgae and turfing algae) within the inner harbour are likely to have exceeded 22 mm during previous dredging activities. Given that sedimentation levels outside Lumsden Point General Cargo Facility footprint are predicted to be similar to the levels predicted for previous dredging projects, no impacts on other BPPs are expected to occur.

Conclusion

The PHPA considers that the Lumsden Point General Cargo Facility can be constructed and operated without resulting in any significant environmental impacts.

To ensure the predicted impacts associated with the project will be limited to those defined, a comprehensive Construction and Dredging Management Plan (CDMP) has been developed for the Lumsden Point General Cargo Facility. The CDMP includes detailed management controls to avoid, minimize and manage potential environmental impacts. The PHPA has considered the available monitoring data from a range of recent capital dredging projects to also develop a targeted monitoring program for the Lumsden Point General Cargo Facility.

ACRONYMS

3D	Three Dimensional
ARI	Assessment on Referral Information
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulfate Soil
BPP	Benthic Primary Producer
BPPH	Benthic Primary Producer Habitat
CD	Chart Datum
CDMP	Construction and Dredge Management Plan
DEC	Department of Environment and Conservation
DHI	Danish Hydraulic Institute
DMMA	Dredge Material Management Area
EAG	Environmental Assessment Guideline
EPA	Environmental Protection Authority
EP Act	Environmental Protection Act 1986
EV	Environmental Value
FMG	Fortescue Metal Group
GPS	Global Positioning System
ha	Hectare
LAU	Local Area Unit
MIKE3D HD	MIKE3D Hydrodynamic
MIKE3D MT	Mike3D Mud Transport
NOx	Nitrate and Nitrite
NWIO	North West Iron Ore Alliance
P	Phosphorous
PER	Public Environmental Review

PHP	Port Hedland Port
PHPA	Port Hedland Port Authority
TOC	Total Organic Carbon
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
UDP	Ultimate Development Plan

1. INTRODUCTION

1.1 Background

Located in Western Australia's Pilbara region, Port Hedland port is Australia's largest tonnage individual port with a total throughput of 288.4 million tonnes for the 2012–13 financial year. Most of this trade is sourced from mines in the Pilbara region. The current worldwide demand for Pilbara iron ore is outweighing export capabilities and new infrastructure is required to maximise export opportunities.

In its port development planning, the Port Hedland Port Authority (PHPA) has identified Lumsden Point as a potential site to develop a common user facility, both to alleviate trade growth pressures on Berths 1, 2 and 3 and to accommodate potential marine supply trades supporting the offshore oil and gas and other industries.

The PHPA propose to develop the Lumsden Point General Cargo Facility (Figure 1) the project) as a multi-user general cargo facility, focused primarily on the import of general cargo goods such as containers, cement and ammonium nitrate. It is being developed to ease congestion on current general cargo berths in response to significant growth associated with expansion in the iron ore mining sector.

1.2 Purpose of this document

This document has been prepared as part of the formal referral of the Lumsden Point General Cargo Facility to the Office of the Environmental Protection Authority (OEPA) for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). This document has been prepared in accordance with referral guidelines and provides the key environmental information in relation to the Lumsden Point General Cargo Facility. A separate EPA referral form has been completed for the project in which it is suggested that the appropriate level of assessment is 'Assessed on Proponents Information'. The level of assessment identified within the referral form is based on discussions with the EPA and accurate identification of impacts associated with the project, as well as on previous dredging projects undertaken adjacent to the proposed dredge footprint and their identified impacts. It should be noted that most of the disturbance footprint is included within existing approvals relating to other projects, in particular the approvals under the OEPA Ministerial Statements 690, 771, 812 and 859, and the approved Small Vessel Cyclone Mooring Protection Facility.

The PHPA has also committed to robust management and monitoring to mitigate impacts associated with the Lumsden Point General Cargo Facility.

The purpose of this document is three-fold:

- to demonstrate that the potential environmental impacts from dredging during development of the Lumsden Point General Cargo Facility can be readily managed to meet the EPA's environmental objectives;

- to define the PHPA's commitment as the proponent to manage the Lumsden Point General Cargo Facility in an environmentally acceptable manner; and
- to demonstrate that the environmental impact of the Lumsden Point General Cargo Facility will be similar to or less than those already assessed by the EPA for other existing marine projects in the Port Hedland area and hence can be readily managed to meet the EPA's objectives.

1.3 Proponent

The proponent is the PHPA, a state-government-owned trading enterprise that operates under the *Port Authorities Act 1999*. Under this Act, the PHPA facilitates trade and commerce within and through the port, and maintains several wharf and berth areas, shipping channels and swing basins within it.

The PHPA's office is located in West Perth, Western Australia:

Port Hedland Port Authority
Level 1, 1195 Hay Street
West Perth 6005
Western Australia

The nominated proponent contact for the Lumsden Point General Cargo Facility is:

Paul Mackey
Environment and Heritage Manager
T: 08 9173 0021
Email: paul.mackey@phpa.com.au

Further information about the PHPA can be found at **www.phpa.com.au**.

1.4 Project location

The Lumsden Point General Cargo Facility is located in the Town of Port Hedland, approximately 1,660 km north of Perth in Western Australia's Pilbara region. Lumsden Point is situated at the junction of South East Creek and South Creek within Port Hedland port's inner harbour (Figure 1), approximately 5 km south of the Port Hedland townsite and adjoining the existing light industrial area of Wedgefield.

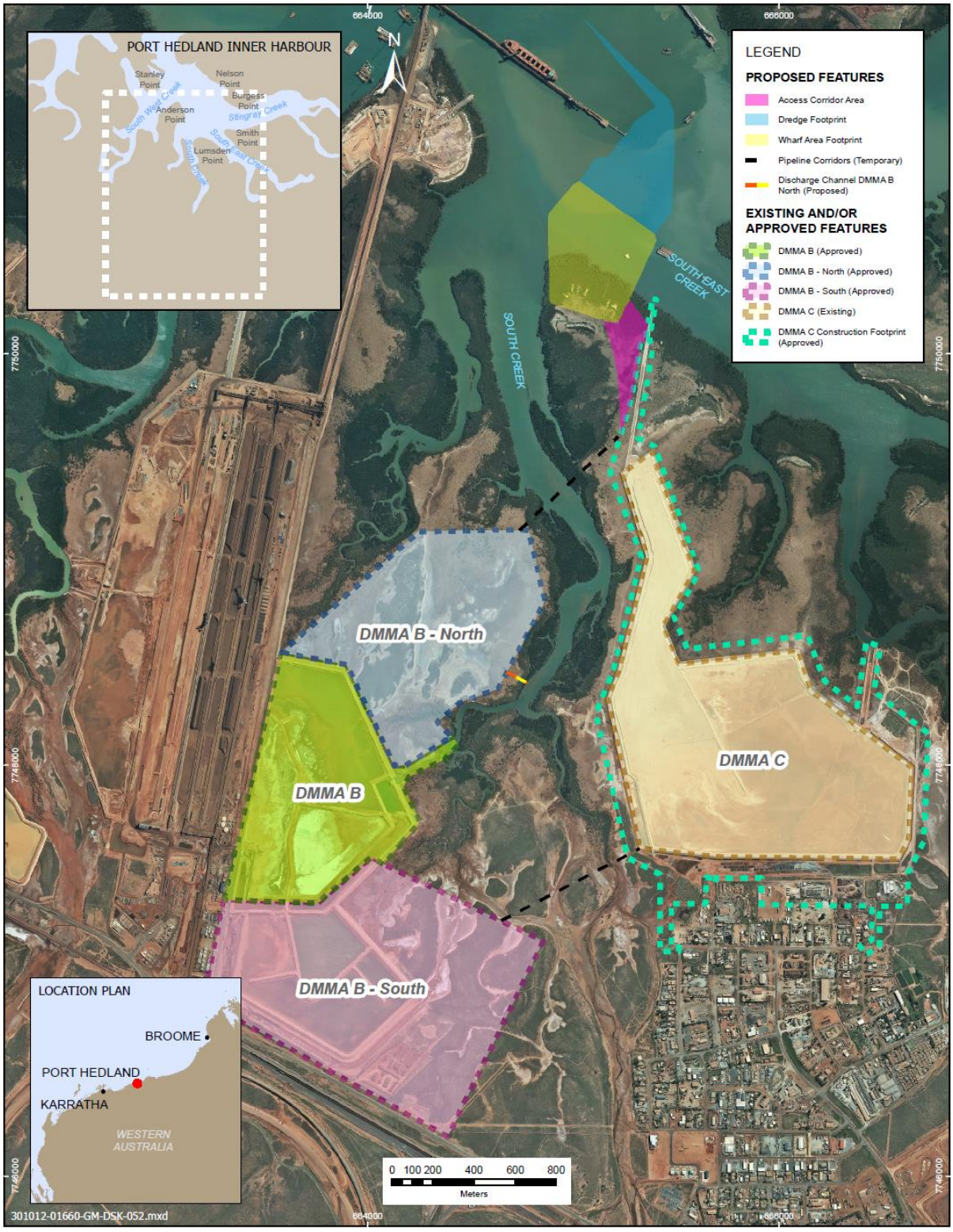


Figure 1: Location of the Lumsden Point General Cargo Facility and its layout.

1.5 Assessment approach

The EP Act is the principal statute that governs environmental protection in Western Australia. The Act is administered by the OEPA, the Department of Environment Regulation (DER), the Department of Parks and Wildlife (DPaW) and the Minister for the Environment.

A wealth of environmental data and information is available for the Port Hedland region, following the environmental approval and monitoring of several large-scale port infrastructure projects in recent years. Table 1 provides a summary of the most recent projects approved and their level of assessment, and indicates whether environmental monitoring data was collected during their construction and/or operation.

Table 1: Summary of projects previously undertaken in the Port Hedland area

Project	Level of assessment	Monitoring data collected
FMG – Anderson Point Project	Public Environmental Review (PER)	Yes
Harriett Point RGP5 Project	Assessment on Referral Information (ARI)	Yes
Nelson Point RGP6 Project	ARI	Yes
Utah Point Port Development	PER	Yes
FMG Third Berth	ARI	Yes
South West Creek Tug Boat and Cyclone Mooring Facility	Not assessed	Yes
South West Creek Dredging and Reclamation Project	API	Yes
Hunt Point Tug Harbour	Not assessed	Yes
Stingray Creek Cyclone Mooring Facility	Not assessed	Yes
Outer Harbour Development	PER	No*

*Note: Project has not begun from a compliance perspective

Existing information from other nearby infrastructure developments has allowed potential environmental and social impacts to be well understood. Other recent larger projects involving dredging, such as the PHPA's South West Creek Dredging and Reclamation project and BHP Billiton Iron Ore's RGP5 and RGP6 projects, have been assessed as Assessment on Referral Information (ARI) (BHPBIO 2008; BHPBIO 2009). Management and mitigation measures that have been used for previous dredging developments in the area and their relative effectiveness are also well known.

An extensive literature review of existing reports and a gap analysis of existing information for the area have been completed. In addition, site-specific survey work of marine benthic habitat and terrestrial flora, vegetation and fauna has also been undertaken. This

information, together with other social, heritage and engineering considerations, has been used to generate the final design.

The PHPA believes that by using this wealth of environmental data and information, along with the assessments completed for this environmental impact assessment, it can manage the Project's development and operation within the existing EPA policy framework.

Biodiversity principles have been applied during the Lumsden Point General Cargo Facility planning phase to ensure that potential environmental impacts are identified and avoided as far as practicable. These principles form an integral part of the impact assessment approach outlined in this referral document and have been used to guide the preferred dredge method and management of materials. A qualitative risk-based approach has been adopted to systematically determine the relevant environmental and social risks posed by the project. These risk factors have been identified through a review of existing information, findings of investigative studies and consultation with relevant stakeholders.

Environmental and social factors were determined to be key issues for the Lumsden Point General Cargo Facility if they:

- had a high inherent risk to the environment if left unmanaged;
- required more detailed assessment; and
- required specific management measures and controls to ensure minimal impacts.

The key environmental factors identified for the project were:

- marine water quality; and
- Benthic Primary Producer Habitat (BPPH).

Other relevant environmental factors have been assessed by the PHPA as part of this project. Environmental factors, termed 'other' environmental factors, were not considered key factors if they:

- had a moderate or low inherent risk to the environment if left unmanaged;
- required a less detailed assessment; and
- could be managed via existing controls, other instruments and/or supporting procedures.

These factors are not expected to be significantly affected by the Lumsden Point General Cargo Facility and are collectively assessed in Section 7.

1.6 Alternative Options Considered

The PHPA considered a number of options to determine a cost-effective and environmentally, socially and culturally acceptable development outcome. A summary of the key options are discussed below.

No Development Option

Although the no development option would eliminate any environmental impacts associated with the development, the PHPA's Berths 1, 2 and 3 would reach capacity by 2014. If the PHPA cannot alleviate trade growth pressures on Berths 1, 2 and 3, there will be increased waiting time for vessels to access port facilities, limitations to port export capacity and the PHPA will not meet its legislated obligation to facilitate trade through the port. Indirect impacts on reduced service by the PHPA could potentially result in a loss of earnings to the State revenue and Port Users due to project delays and increased demurrage costs. Ultimately this could cause current Port Users to identify alternative locations outside of Port Hedland for imports and exports.

Development Options

Several design alternatives were considered and assessed by the PHPA. Design alternatives that were evaluated included:

Option 1. Finger wharf

Option 2. Wharf with land backed access (onshore reclamation)

Option 3. Wharf with land backed access (onshore and offshore reclamation)

Option 4. Wharf with land backed access (onshore and offshore reclamation), with access built around mangroves to minimise mangrove loss (see Table 2)

The options were evaluated against a number of broad criteria including:

- maritime safety, in particular conflict with existing port operations;
- volume of material to be dredged and environmental impacts;
- ability to complement and support an adjacent logistics and industrial precinct; and
- potential for low impact future expansion to maximise Inner Harbour port capacity.

Table 2: Options Considered

Option Considered	Key Considerations
1 – Finger wharf	• Smaller area of direct mangrove loss (≅1 ha of direct loss). • Larger dredging volume. • Restricts any future development in South East Creek (such as the proposed PFSCUF development). • Does not meet long-term port needs in line with growth forecasts. • Does not provide enough land backed access to service the logistical needs.

Option Considered	Key Considerations
2 – Wharf with land backed access (onshore reclamation)	• Moderate mangrove footprint (≅9 ha of direct loss) • Larger dredging volume. • Requires construction of a new onshore dredge material management area (DMMA) • Does not meet long-term port needs in line with growth forecasts. • Provides enough land backed access to ensure adequate space and access in the short term but not the longer term.
3 – Wharf with land backed access (onshore and offshore reclamation)	• Larger mangrove footprint (14.42 ha of direct loss). • Smaller dredging volume. • Accommodates Master Planning of the PFSCUF. • No requirement for a new onshore DMMA. • Meets long-term port needs in line with growth forecasts. • Provides enough land backed access to ensure the project's logistical space requirement in the short and long term. • Avoids additional direct mangrove loss by creating land-backed access offshore through reclamation
4 - Wharf with land backed access (onshore and offshore reclamation), with access built around mangroves to minimise mangrove loss	• Mangrove Footprint less than that of Option 3 (13.88 ha of direct loss) through access corridor optimisation. • Smaller dredging volume. • Accommodates Master Planning of the PFSCUF. • No requirement for a new onshore DMMA. • Meets long-term port needs in line with growth forecasts. • Provides enough land backed access to ensure the project's logistical space requirement in the short and long term. • Avoids additional direct mangrove loss by creating land-backed access offshore through reclamation

During the assessment process, the PHPA took a strategic approach and considered both the present critical capacity constraints experienced at berths 1, 2 and 3 and the future requirements for the Port Hedland Port. The assessment accommodates the potential marine supply trade supporting the offshore oil and gas and other industries, which is expected to continue to increase commensurate with tonnage throughput. Accordingly, whilst not a part of this proposal, the final design footprint captures the PHPA's ultimate development scenario for its Lumsden Point General Cargo Facility and has been designed with provision to accommodate additional berths in the future through incremental development with minimal further mangrove and dredging impacts (Figure 2).

The PHPA acknowledges that whilst adopting a strategic approach has increased the mangrove footprint of the proposed development, it has also "future proofed" the development to reduce the likely future environmental impacts. The PHPA notes that the land backed wharf area is constructed from reclaimed dredge material that is required to be dredged to create the approach channel and berth pockets and is therefore unable to be developed in stages, so the majority of mangrove loss is realised upfront with this proposal. In developing this option the PHPA has been cognisant of the EPA's previous advice to focus on longer-term planning and the PHPA considers this option delivers an overall saving in mangrove habitat over the long term.

The PHPA considers that this approach provides the EPA with an overview of the ultimate development scenario for the Port Hedland Port's Lumsden Point General Cargo Facility, from which the potential significance of environmental impacts may be considered. The PHPA also considers that this proposal would provide cost effective trade opportunities for future port users that may negate the requirement for isolated further developments and any associated habitat loss. Accordingly, the PHPA considers Option 4 to be the best option to conserve mangroves in the longer term.

The final design has also been developed in consultation with the Department of Commerce (DoC), the lead agency for the proposed Pilbara Fabrication and Services Common Use Facility (PFSCUF). The PHPA's final design option accommodates the requirements of both the PHPA and the Master Planning of the DoC to ensure a coordinated approach to planning that maximises the economic development opportunities in the Pilbara with an optimised environmental impact.

Preferred Option - Option 4

The preferred development option (Option 4) presented in the referral document has the following advantages:

- the access corridor has been aligned to avoid encroaching on mangrove habitat;
- the proposal reduces the volume of dredging required by minimising the channel length;
- the proposal makes use of existing or approved DMMAs, negating the requirement for new DMMAs and associated vegetation loss;
- there is no requirement for dredged material to be deposited into the offshore marine environment;
- the proposal does not significantly impede on designated cyclone moorings areas within the Port Hedland Port;
- the proposal can be developed with construction and operational cost settings appropriate for the proposed scale of development;
- the proposal strategically links to the Great Northern Highway realignment, delivering long-term social benefit by redirecting traffic away from Port Hedland;
- the proposal accommodates the Master Planning requirements of the DoC's proposed PFSCUF; and
- the design includes potential for future expansion to ensure the port effectively meets the needs of port users and efficiently uses the port area to maximise Inner Harbour port capacity, whilst minimising the overall impacts to mangroves.

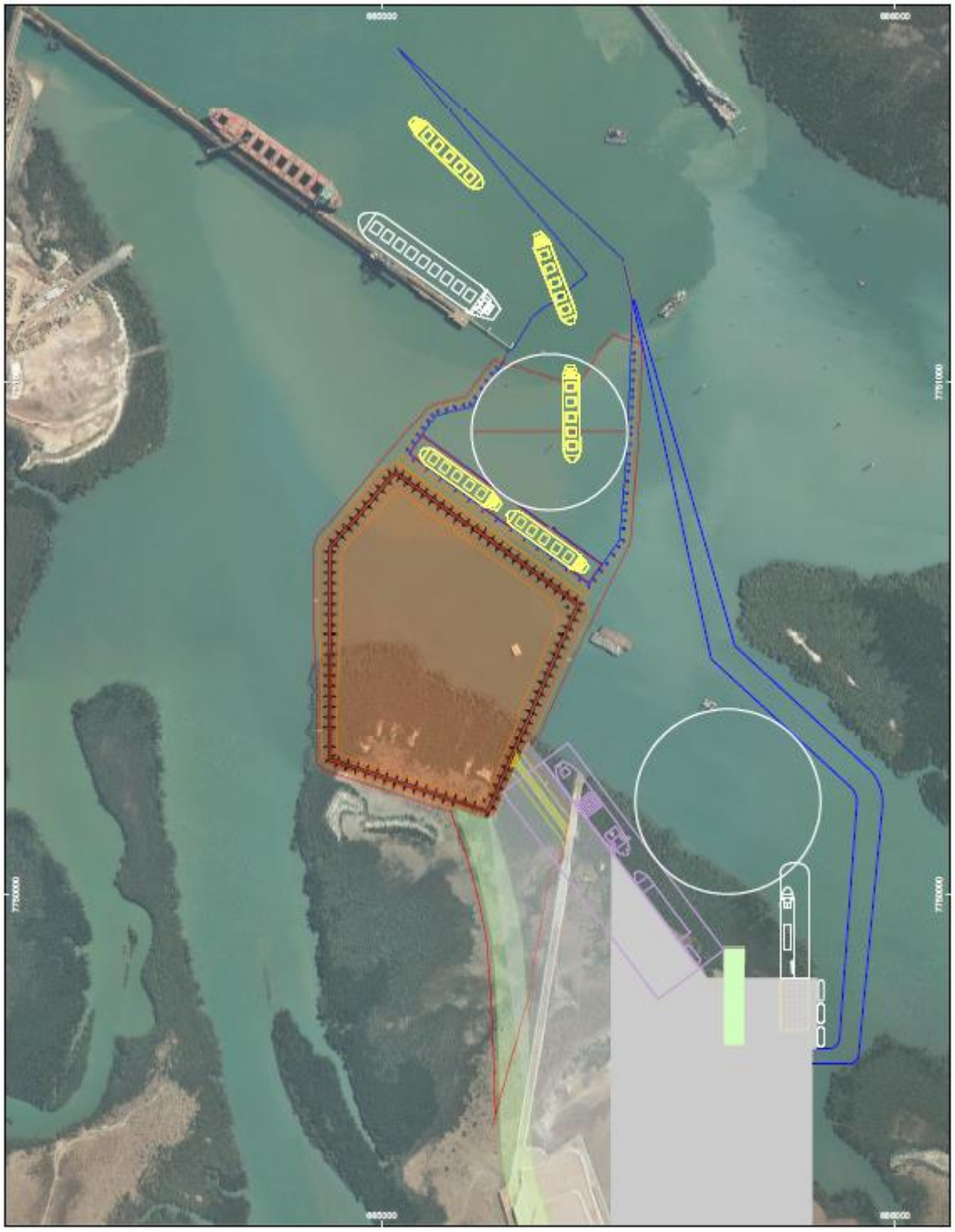


Figure 2: Master Plan for Lumsden General Cargo Facility depicted with a concept design for the potential PFSCUF development (proposed by the Department of Commerce)[1].

[1] Note: Potential future berths alongside the General Cargo Facility are not part of this proposal and are only indicative to articulate the PHPA Ultimate Development Design Concept.

1.7 Applicable legislation

1.7.1 Commonwealth legislation

Key Commonwealth legislation of relevance to the Lumsden Point General Cargo Facility includes:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);

No significant impacts to matters of national environmental significance are anticipated to result from the project's development and operation. As such, it is considered that referral of the project to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) under the provisions of the EPBC Act is not required.

Other legislation and regulations that may also apply to the Lumsden Point General Cargo Facility include:

- Australian Ballast Water Management Requirements and Australian Quarantine Regulations 2001;
- *Australian Maritime Safety Authority Act 1990*;
- Environment Protection and Biodiversity Conservation Regulations 2000;
- Environment Protection (Sea Dumping) Regulations 1983 (it is currently understood that offshore disposal is not proposed and therefore referral of a Sea Dumping Permit is not required);
- *Navigation Act 2012*; and
- *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*.

1.7.2 State legislation

The key Western Australian legislation and regulations relevant to the Lumsden Point General Cargo Facility include:

- *Environmental Protection Act 1986*; and
- Environmental Protection Regulations 1987.

Other legislation and regulations that may also apply to the project include:

- *Aboriginal Heritage Act 1972*;
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004;
- Environmental Protection (Noise) Regulations 1997;
- *Fish Resources Management Act 1994*;
- *Main Roads Act 1930*;
- *Marine and Harbours Act 1981*;

- *Native Title (State Provisions) Act 1999*;
- *Pollution of Waters by Oil and Noxious Substances Act 1987*;
- *Port Authorities Act 1999;*
- *Shipping and Pilotage Act 1987;*
- *Western Australian Marine (Sea Dumping) Act 1981;*
- *Western Australian Marine Act 1982*; and
- *Wildlife Conservation Act 1950.*

1.7.3 Guidelines and statements

The state and federal governments, along with the EPA, provide direction for environmental protection and impact assessment through published guidelines, standards and position statements.

The key EPA position and guidance statements likely to be relevant to the Lumsden Point General Cargo Facility are:

- Environmental Assessment Guideline 1: Environmental Assessment Guideline for Defining the Key Characteristics of a Proposal *Environmental Protection Act 1986* (EAG1) (EPA 2012);
- Environmental Assessment Guideline 3: Protection of benthic primary producer habitats in Western Australia's marine environment (EAG3) (EPA 2009);
- Environmental Assessment Guideline 6: Revised Environmental Assessment Guideline for Timelines for environmental impact assessment of proposals (EAG6) (EPA 2013a);
- Environmental Assessment Guideline 7: Environmental assessment guidelines for marine dredging proposals (EAG7) (EPA 2011);
- Environmental Assessment Guideline 8: Environmental Assessment Guideline for Environmental factors and objectives (EAG8), (EPA 2013b);
- Guidance statement 7: Principles of environmental protection (EPA 2004b);
- Guidance statement 1: Protection of tropical arid zone mangroves along the Pilbara coastline (EPA 2001);
- Guidance statement 8: Environmental noise (draft) (EPA 2007);
- Guidance statement 41: Assessment of Aboriginal heritage (EPA 2004a); and
- Guidance statement 55: Implementing best practice in proposals submitted to the environmental impact assessment process (EPA 2003).

Key DEC and other state guidelines relevant to the proposal include:

- General guidance on managing acid sulfate soils (DoE 2003b);
- Identification and investigation of acid sulfate soils (DEC 2013);

- Pilbara coastal water quality consultation outcomes – environmental values and environmental quality objectives (DoE 2006); and
- Preparation of acid sulfate soil management plan (DoE 2003a).
- National guidelines and standards relevant to the proposal include:
- Australian and New Zealand guidelines for fresh and marine water quality(ANZECC/ARMCANZ 2000);
- National assessment guidelines for dredging (Commonwealth of Australia 2009); and
- National strategy for the management of coastal acid sulfate soils (ARMCANZ & ANZECC 2000).

2. PROJECT DESCRIPTION

2.1 Project location and existing land uses

The proposed Lumsden Point General Cargo Facility location at Lumsden Point is an undeveloped area between the mouth of South Creek and South East Creek. The FMG Anderson Point port facility and iron stockpile and offloading facility are located to the west and the existing Dredge Material Management Areas (DMMA) C and B are located to the south and west of the development area respectively.

2.2 Project overview

The proposed works for the Lumsden Point General Cargo Facility will include:

- two Handymax berths totaling a length of 500 metres (m);
- dredging of up to -13.5 m chart datum (CD) for the berth pocket;
- dredging of up to -12 m CD for the access channel;
- developing an area of land immediately behind the berths;
- dredge spoil disposal (onshore only, to existing DMMA); and
- causeway access from land-based facilities to the wharf area.

The Lumsden Point General Cargo Facility key characteristics are detailed in Table 4. A general layout of the project is provided in Figure 3. The majority of the proposed disturbance area has already been previously approved under existing Ministerial Statements or projects. Table 3 shows the areas of disturbance not requiring further approval for this project. The approved and proposed areas of the Lumsden Point General Cargo Facility layout is shown in Figure 4, and the proposed potential BPPH direct disturbance is presented in Figure 5.

Table 3: Areas of proposed disturbance not requiring further approval under this referral

Element	Location	Proposed Extent Authorised	
Project development disturbance area already approved for disturbance (including dredge material management areas, dredge area and part of land backed wharf area)	Green areas shown in Figure 4	Dredge and Wharf area	31.66 ha
		DMMA C	204 ha
		DMMA B	75.35 ha
		B North	80.46 ha
		B South	129.92 ha
		TOTAL	**521.39 ha**

Table 4: Key characteristics of the Lumsden Point General Cargo Facility

Summary of the Proposal		
Project name	Lumsden Point General Cargo Facility	
Proponent name	The Port Hedland Port Authority (PHPA)	
Short description	This proposal is to undertake dredging and construction to develop a general cargo facility at Lumsden Point, located in the Port of Port Hedland. Construction will include two Handymax berths totalling a length of 500 m, development of land immediately behind the berths and causeway access from land-based facilities to the wharf area.	
Project schedule	Dredging to begin first quarter 2014 for a 20-week period. Completion of dredging, wharf and land-based construction to be completed thereafter.	
Element	**Location**	**Proposed Extent Authorised**
Physical Elements		
Dredge material for channel, swing basin and berth pocket	Lumsden Point, Figure 3	Up to 2 million m^3 within pre-existing approved area
Total proposed disturbance footprint area to be assessed	Terrestrial and marine area for land backed wharf area shaded in red, Figure 4	Up to no more than 21.34 ha
	Discharge Channel proposed footprint, East of DMMA-B, shaded in red, Figure 4	Up to no more than 0.11 ha
	Temporary pipeline corridors (North and South), hashed black lines, Figure 4	Up to no more than 1.41 ha
	Total of the red polygons, Figure 4	Up to no more than 22.86 ha
BPPH Impacts within proposed disturbance footprint area		
Area of mangrove impact	Figure 5	13.88 ha[1]
Area of bare substrate impact	Figure 5	8.34 ha
Area of seagrass impact	Figure 5	0 ha
Area of hard coral impact	Figure 5	0 ha

[1] this includes provision for loss of 0.19 ha of mangrove from the north pipeline corridor

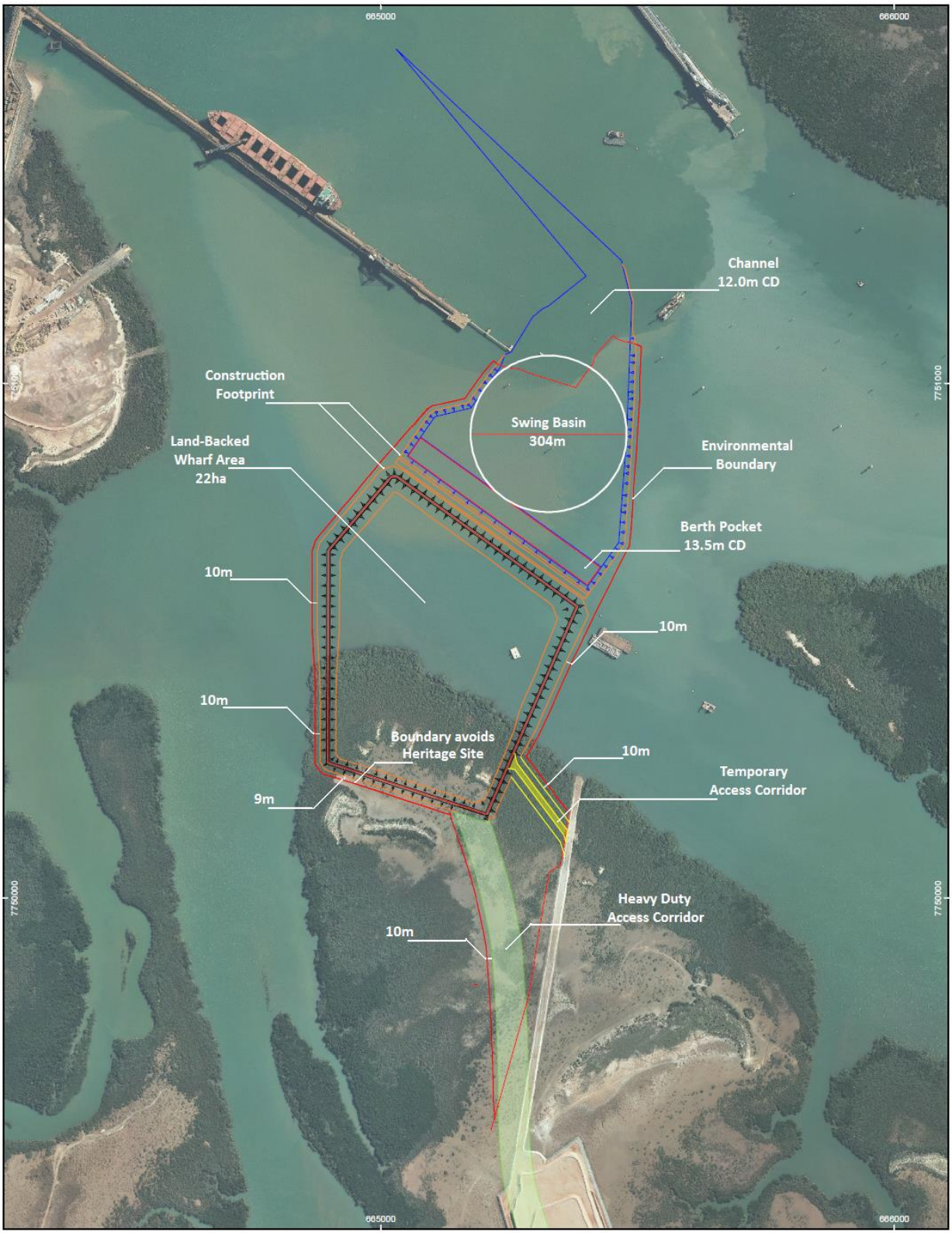


Figure 3: General design layout of the proposed Lumsden Point General Cargo Facility.

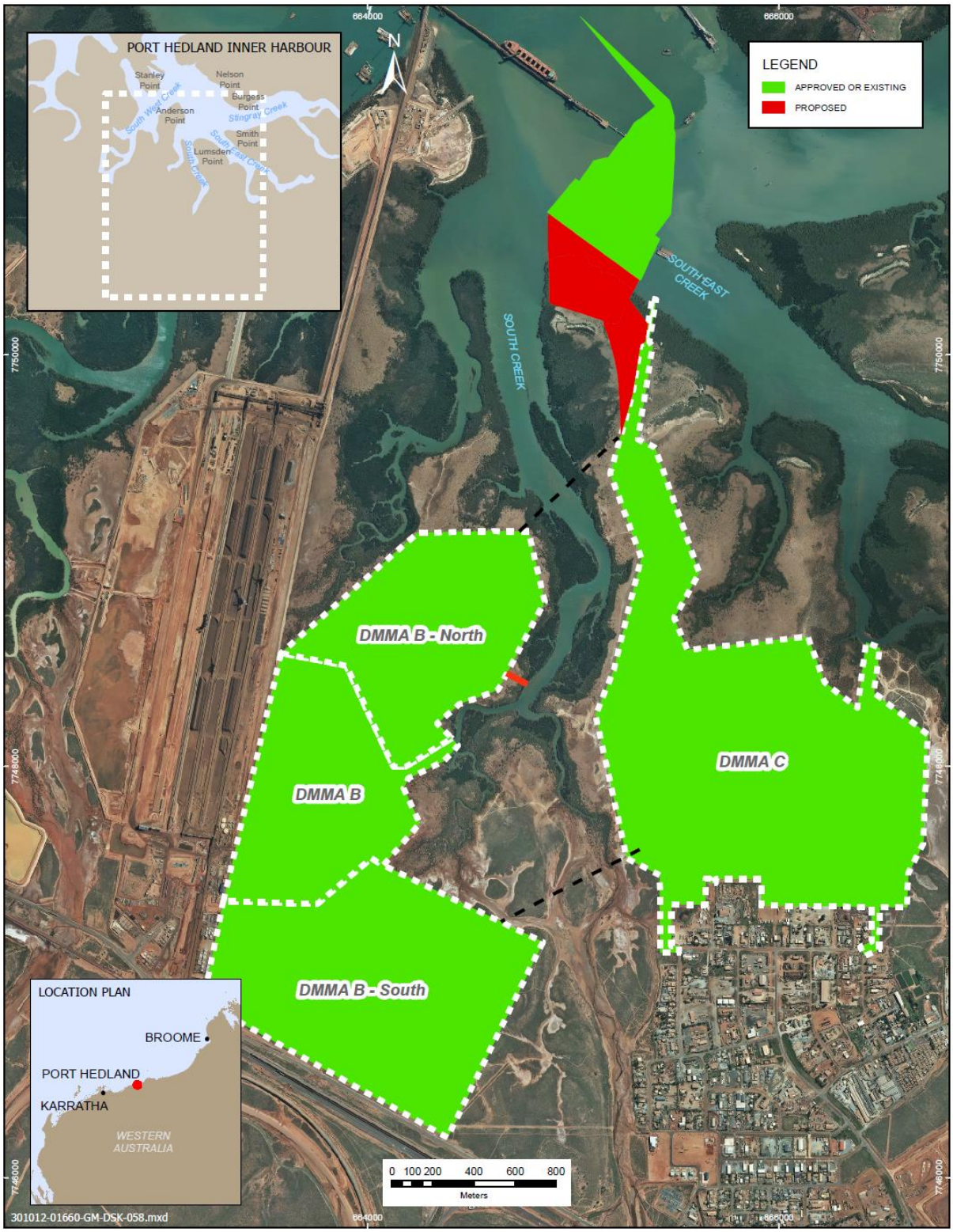


Figure 4: Approved and Proposed areas of the Lumsden Point General Cargo Facility disturbance areas.

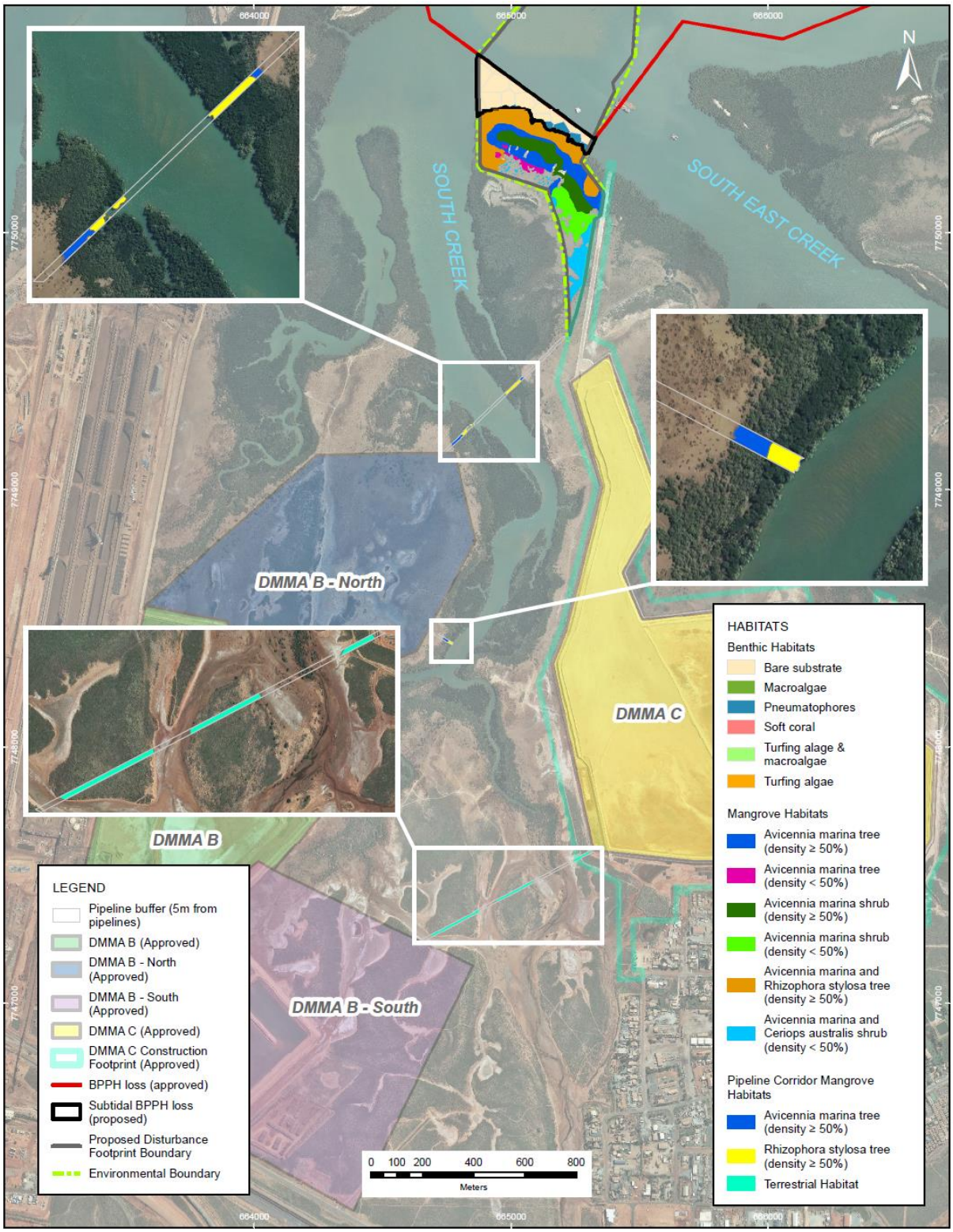


Figure 5: Proposed BPPH disturbance directly due to the Lumsden Point General Cargo Facility.

2.3 Project approval requirement

The proposed Lumsden Point General Cargo Facility will include disturbance or use of areas that have either been approved or developed previously. Onshore disposal of material into each of the five DMMAs has already been approved under a series of ministerial statements detailed in Section 2.3.4. Impacts associated with the development of each area have been assessed and approved in accordance to relevant state and federal legislation. All management and monitoring of these areas including management of dewatering activities will be done in accordance with each respective set of ministerial conditions for each DMMA.

At this stage it is likely the proposed temporary pipelines to transfer material between DMMAs will not be required; however, should pipelines be needed a corridor of will be developed between the wharf area and DMMA B North and/or DMMA C and DMMA B. It is expected that vegetation within each corridor would be disturbed but not permanently lost, and would recover over time. However, it is possible that the mangroves may not recover within five years, and therefore they have been presumed to be permanent mangrove loss and provision for the proposed temporary pipeline routes has been assumed and included in the proposed assessment as a conservative approach.

This area is relatively small (compared to the area of permanent loss) and the area of potential disturbance to mangroves associated with the temporary access corridors is 0.19 ha for the north pipeline corridor. No mangrove will be affected by the south pipeline corridor (Figure 5).

Based on this, the PHPA requires the Lumsden Point General Cargo Facility to be assessed against the following activities:

- dredging activities within the proposed dredge footprint (less the approved Cyclone Moorings Project footprint);
- construction of the land-backed wharf and associated facilities; and
- construction of the access corridor minus the area approved for the development of DMMA C.

Dredging activities within the proposed dredge footprint are already approved under previous ministerial conditions to a depth of -6 m CD. Nevertheless, impacts related to dredging are reconsidered in this assessment given an additional layer of sediment to a depth of -13.5 m will be removed. The entire dredging volume has been included in this assessment.

2.3.1 Dredging activities

The Lumsden Point General Cargo Facility construction involves dredging of the intertidal and subtidal areas of the inner port area adjacent to the north of Lumsden Point to establish an access channel, swing basin and berthing pocket. The dredging footprint occurs in an area of shallow bathymetry, ranging from 0 m CD to -6.0 m CD. The site is partially sheltered from wave energy but is subject to high velocity tidal flow.

The proposed dredging will comprise the following components:

- access channel dredged to a maximum depth of -12.0 m CD;

- berth pockets will be dredged to a maximum depth of -13.5 m CD; and
- ancillary seabed disturbance associated with dredging, including dredge anchor and spud placement.

Up to two million cubic metres of material will need to be dredged to achieve the required design depths for safe navigation. The volume of material to be dredged includes over-dredging of 0.5 m below the maximum design depth in each dredge pocket. Maximum depth of batters has also been used in finalising a maximum dredge volume and rounded up for contingency purposes. The dredging activities are expected to be conducted over approximately 20 weeks based on a dredge volume rate of 1000 m^3/hour. Dredging is proposed to be undertaken using a single cutter suction dredge.

The indicative extent of dredging required for safe navigation of vessels using the proposed Lumsden Point General Cargo Facility, including the coordinates of the proposed disturbance footprint, is shown in Figure 10. It is proposed that dredge material will be dredged using a single cutter suction dredge and disposed of onshore within the land-backed wharf area and the previously approved DMMA C.

The PHPA notes that material within the dredged footprint has already been approved for removal to a depth to -6m CD. The PHPA is seeking approval to dredge beyond this depth and for all material within the dredging footprint to be deposited onshore. Within the overall disturbance footprint area for this proposal of 54.52 ha is an offshore area of 31.66 ha that has already been assessed by EPA for disturbance as part of the PHPA Cyclone Moorings Project. Therefore, the additional disturbance footprint area requiring assessment as part of this approval is 22.86 ha (including the discharge channel for DMMA B-North and the temporary pipeline corridors North and South).

Dredge material will be transferred via pipelines (Figure 11). The material will consist of both coarse and fine material. While the coarse material will settle out of suspension rapidly and constitute valuable material to use for the reclamation of the onshore land-backed wharf area, the fine material will either be placed in DMMA C or as a final option be transferred into DMMA B, B North and/or B South.

2.3.2 Wharf development

The development of the land-backed Wharf Common User Area (Figure 10) located immediately behind the two Handymax berths will require an area of 26.3 ha to be reclaimed.

Figure 6: Aerial and ground-level views of a bund wall development similar to what is proposed for the Lumsden Point General Cargo Facility. Note that in these photographs, the core of the wall has been placed, with outer amour rock layers to be installed.

The wharf area will be constructed by firstly building the outer bund wall (sea wall). To construct the bund wall, rock that has been graded and sourced from an existing quarry will be used. The material will be screened to remove the fines fraction (less than 75 mm) to ensure fines are not washed off once placed into the reclamation area.

The rock will be transported to the project site and back-tipped from trucks along the alignment of the bund wall. The rock will be pushed into location by a dozer at the tip face, and trimmed to design by a follow-up team of excavators. The wall will be developed to a level at or above highest astronomical tide, and most likely on two work fronts developing the bund wall out from the landward extent.

Figure 6 illustrates the sequence of events from the recent Future Port Expansion at the Port of Brisbane (2001–04) (DPA 2010).

Following completion of the rock wall, reclamation material will be placed inside the bund wall. Material will be sourced from dredge material within the proposed dredge area if considered suitable for reclamation. If the dredge material is not considered appropriate then the material will be sourced at an off-site location, yet to be determined. It is estimated that 28,663 m^3 of material will be required for developing the 26.3 ha area.

Below Mean Water Level (circa 5.0-6.0mCD), the perimeter bunds will be formed using rock materials. As this material is very porous, in order to prevent leakage of fines through the bund from the subsequent placement of dredge material, the 'grits' material will be placed on the inside of the bund. In order to minimise the volume of rock required, the rock bund

will only be placed to a level of +7.5mCD (around HAT) with the material above (and behind) that being the 'grits' material. This proposed arrangement is shown in Figure 7.

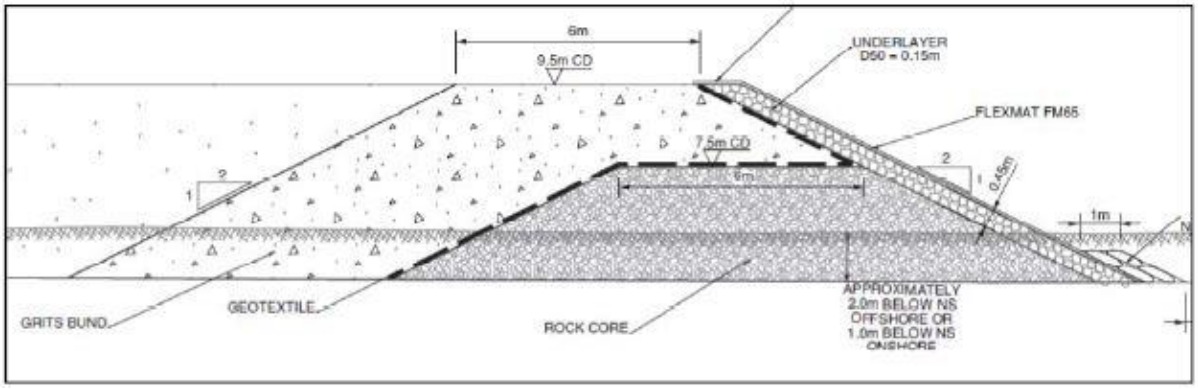


Figure 7 Typical section of rock & 'grits' perimeter bund and slope protection

Under the wharf structure, a similar arrangement to that shown in Figure 7 will also be required, however as a result of the requirement for subsequent dredging works for the berthing pocket, in addition to the pre-removal of the marine sediments further removal of any loose or weathered (Upper Red Beds) materials below also be removed to form a 'toe slot' for the future seawall. This will ensure that once the berth pocket materials are dredged, the seawall will not be undermined through erosion of those looser materials (refer to Figure 8)..

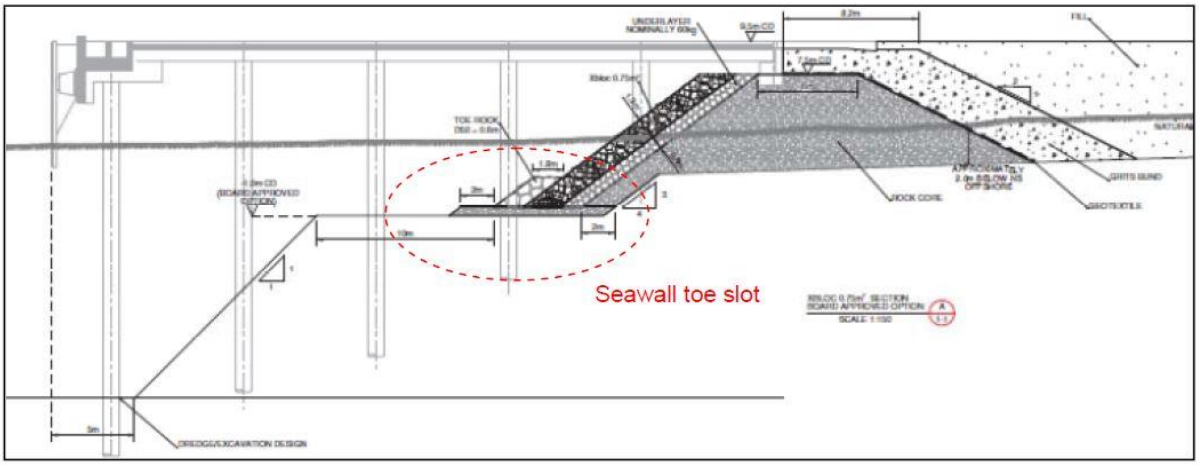


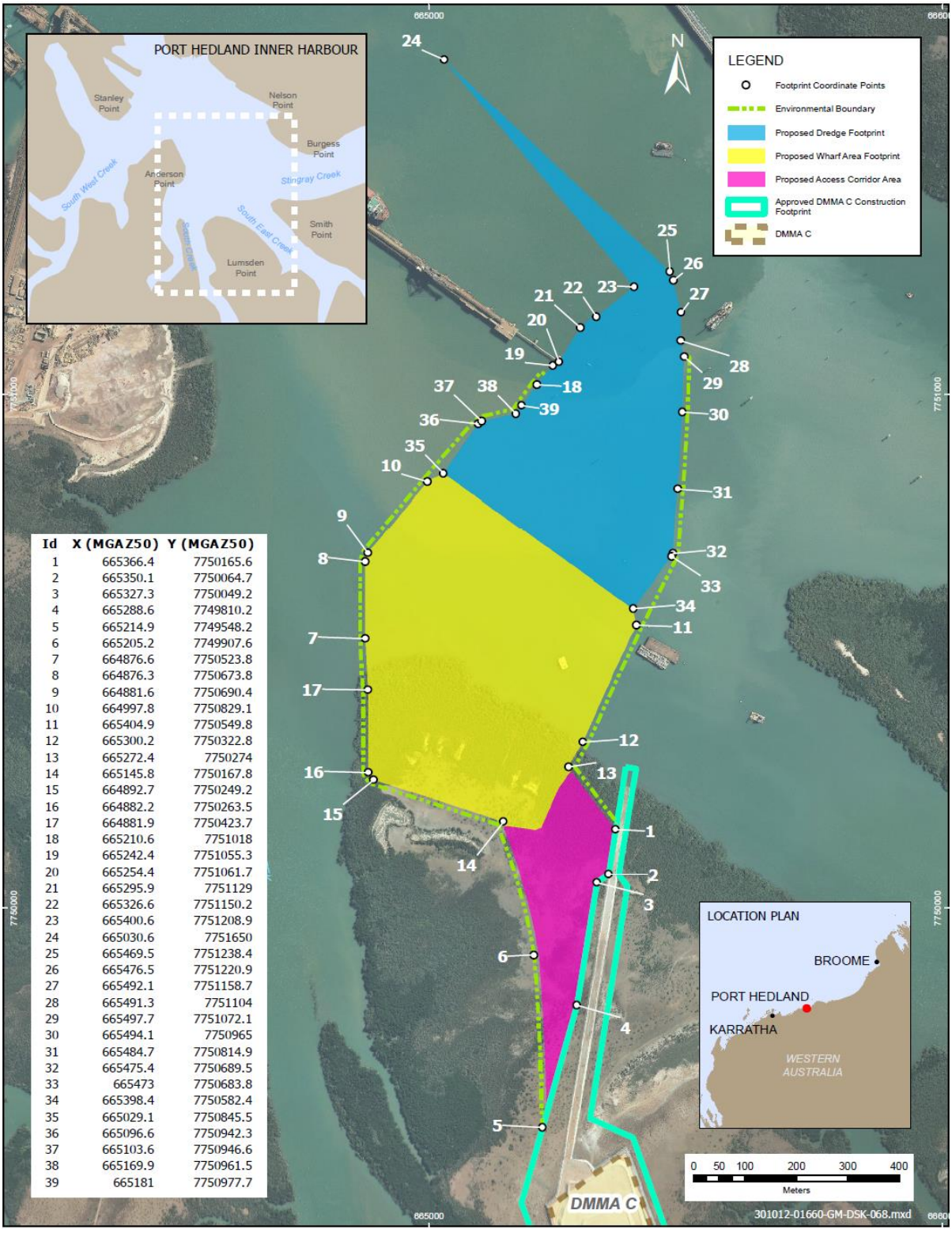
Figure 8 Typical section of rock & 'grits' perimeter bund - slope protection under wharf

When the reclamation area is complete the wharf structure will be constructed. The wharf is likely to be a deck-on-piles structure (Figure 9). Piles will be driven into the substrate, the formwork established and headstocks/decks added to the piles.

Figure 9: Similar piles and wharf structure

2.3.3 Access corridor

The proposed access corridor will comprise two separate causeway developments between the land-backed wharf and the onshore facilities located within the DMMA C construction boundary. A temporary access area will be developed to provide sufficient access for construction vehicles to move between both areas during construction, while a second permanent corridor will be developed for access to and from the wharf area during operation. At present the exact configuration of the two access corridor routes is undecided, however the footprint will not extend outside the existing outer boundaries displayed in Figure 10 and have been included in the mangrove permanent loss calculation



Id	X (MGAZ50)	Y (MGAZ50)
1	665366.4	7750165.6
2	665350.1	7750064.7
3	665327.3	7750049.2
4	665288.6	7749810.2
5	665214.9	7749548.2
6	665205.2	7749907.6
7	664876.6	7750523.8
8	664876.3	7750673.8
9	664881.6	7750690.4
10	664997.8	7750829.1
11	665404.9	7750549.8
12	665300.2	7750322.8
13	665272.4	7750274
14	665145.8	7750167.8
15	664892.7	7750249.2
16	664882.2	7750263.5
17	664881.9	7750423.7
18	665210.6	7751018
19	665242.4	7751055.3
20	665254.4	7751061.7
21	665295.9	7751129
22	665326.6	7751150.2
23	665400.6	7751208.9
24	665030.6	7751650
25	665469.5	7751238.4
26	665476.5	7751220.9
27	665492.1	7751158.7
28	665491.3	7751104
29	665497.7	7751072.1
30	665494.1	7750965
31	665484.7	7750814.9
32	665475.4	7750689.5
33	665473	7750683.8
34	665398.4	7750582.4
35	665029.1	7750845.5
36	665096.6	7750942.3
37	665103.6	7750946.6
38	665169.9	7750961.5
39	665181	7750977.7

Figure 10: Proposed disturbance footprint of the dredge area, land-backed wharf and access corridor. GPS coordinates have been provided to show the extent of the Lumsden Point General Cargo Facility boundary.

2.3.4 Disposal activities

The dredged material will be excavated by cutter suction dredge and transferred to land via pipelines (Figure 11). The material will consist of both coarse and fine material. The fines will be transferred to an approved DMMA, most likely DMMA C which is an approved area of up to 204 ha.

Figure 11: Cutter suction pipelines leading to DMMA C as part of BHPBIO's RGP6 expansion

Should fine material not be transferred to DMMA C, the alternative option is to transfer sediment to one of the three additional approved DMMA areas, namely:

- DMMA B – covering an area of 75.35 ha, which was approved under Ministerial Statement 690 for the FMG Pilbara Iron Ore and Infrastructure Project: Port and North-South Railway (Stage A);
- DMMA B North – covering an area of 80.46 ha, which was approved under Ministerial Statement 859 for the PHPA South West Creek Dredging and Reclamation Project; and
- DMMA B South – covering an area of 129.92 ha, which was approved under Ministerial Statement 771 for the FMG third berth project at Anderson Point.

Transfer of silts between the DMMAs may also be required and will assist with remediation of each DMMA to ensure they are safe, stable and suitable for their designated end land use.

Once sediments have been placed within the designated DMMA, sediments will be separated from the seawater used to transport the sediments to it by circulating the material between

each DMMA. Once sediments have been sufficiently removed, dewatering from the DMMAs will occur at the previously approved discharge location within South Creek at the boundary to DMMA B North or DMMA B (Figure 3 and Figure 12).

Figure 12: DMMA B discharging in 2011 into South Creek.

2.3.5 Pipelines

During dredging activities, dredge material may need to be transferred between DMMAs to reduce water content within the material and/or manage the volume of material between DMMAs. At this stage it is likely that pipelines to transfer material between DMMAs will not be required. However, should pipelines be needed, a temporary corridor of approximately 5 m in width will be developed between the wharf area and DMMA B North and/or DMMA C and DMMA B (Figure 3). These corridors have been mapped and included in the mangrove permanent loss calculation.

2.4 Approval timeframes

Key approval milestone targets for assessment under Section 38 of the EP Act are shown in Figure 13 below.

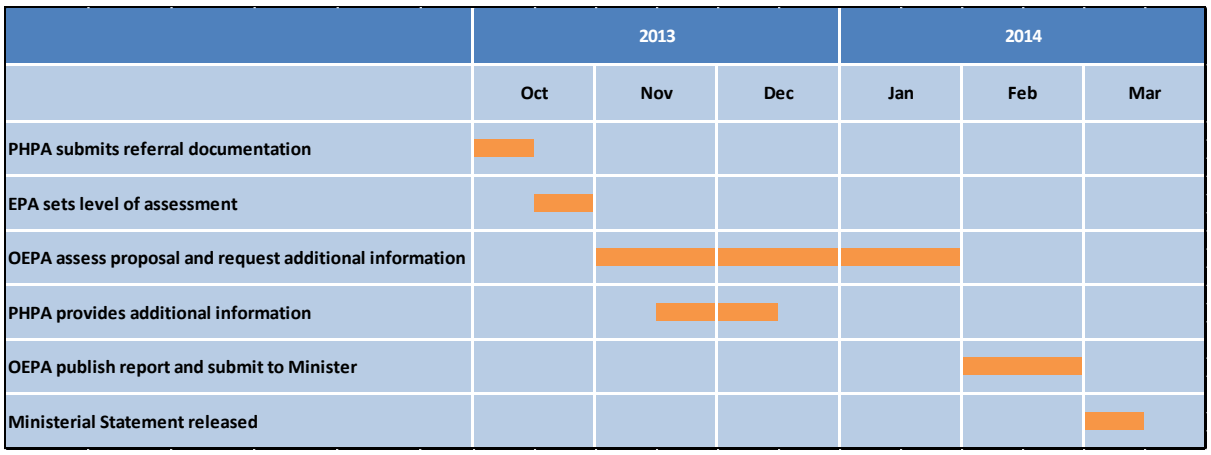


Figure 13: Approval Timeframes

2.5 Tenure

The land and associated seabed within which the proposed dredge footprint lies under the jurisdiction of the PHPA. Under the *Port Authorities Act 1999*, the PHPA is the custodian of all land within the port limits and has the responsibility to ensure that all activities comply with state and federal legislation (Figure 14).

2.6 Land use

2.6.1 Zoning

No amendment to a regional planning scheme and/or town planning scheme is required before the Lumsden Point General Cargo Facility can be implemented.

2.6.2 Land use

No subdivision and/or development approval is required before the Lumsden Point General Cargo Facility can be implemented.

2.6.3 Adjacent land uses

Figure 14 shows the land uses within and around Port Hedland Port. The port infrastructure shown in Figure 14 is existing, currently being developed, or well advanced in the planning or implementation stages.

In summary, BHP Billiton has four iron ore loading berths at Nelson Point and four iron ore loading berths at Finucane Island; FMG has three iron ore berths at Anderson Point and one additional berth being developed in South West Creek; and the PHPA has three public berths on the east side and one on the western side of the port entrance. An additional seven

berths have been approved for development within South West Creek for a range of potential customers including TPI, Roy Hill Iron Ore and North West Iron Ore. Two offshore development areas are also proposed. All port infrastructure has supporting facilities including stockpile and/or rail infrastructure to support the transport, loading, export and import of materials (Figure 14).

In the 2003 *Ultimate Development Plan* (UDP) (WorleyParsons 2003), several areas were identified for reclamation and subsequent use for cargo storage or associated industry. These areas were reviewed and modified in the UDP 2007 (WorleyParsons 2007) to provide land closer to future berths and to minimise, as far as is possible, impacts on mangroves. These areas are referred to as areas A to G and other areas that already exist or could be developed to support port activities are illustrated in Figure 14 as DMMAs.

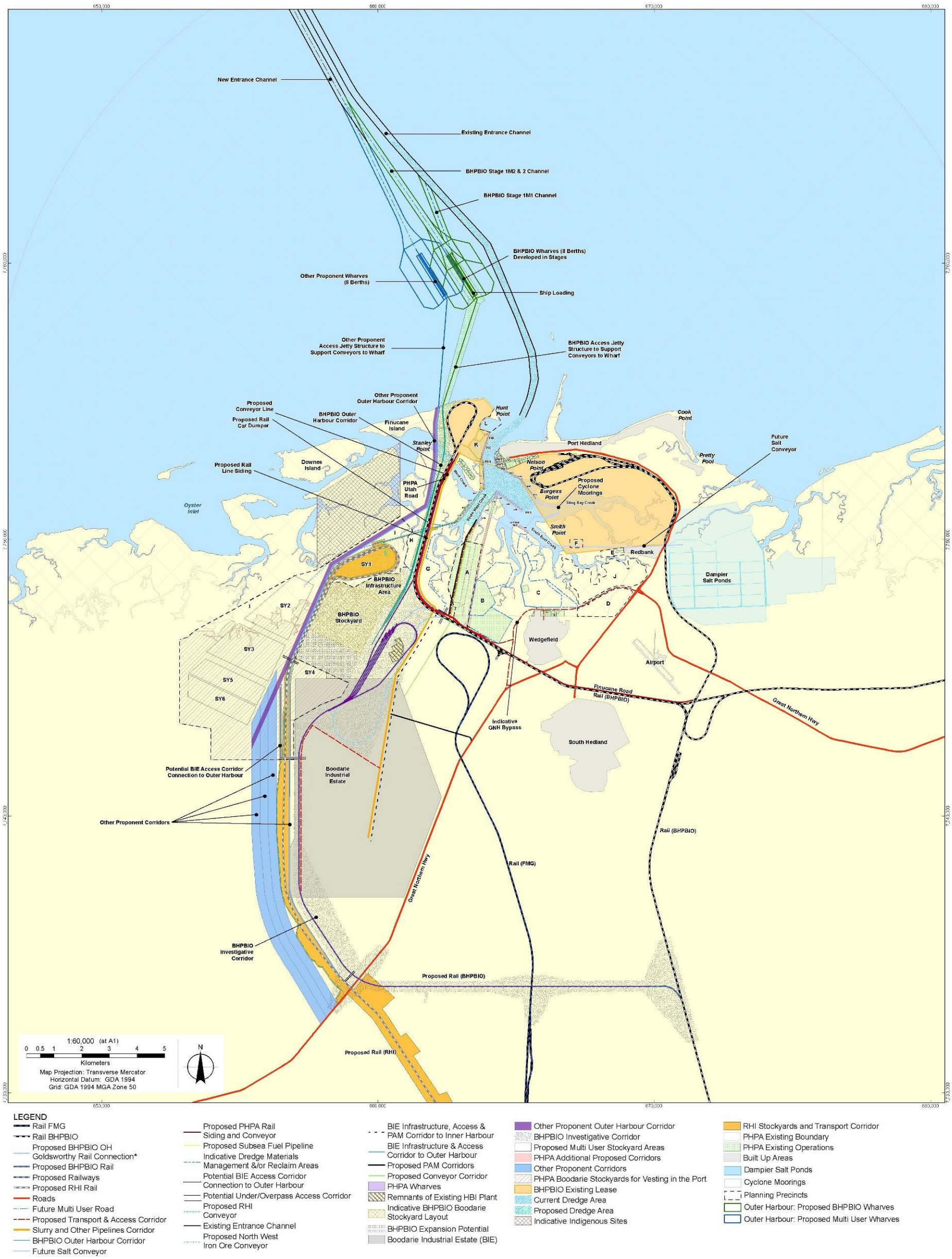


Figure 14: Land uses located within the PHPA's administrative boundary

3. MODELLING

3.1 Sediment dispersion modelling

WorleyParsons conducted sediment dispersion modelling to determine the impact of dredging on water quality by identifying changes to SSCs and sedimentation. The sections below summarise the model inputs and outputs. A full report on the sediment dispersion modelling is provided in Appendix 4.

3.1.1 Model set up and calibration

The proposed impacts on turbidity and sedimentation levels within Port Hedland inner harbour during Lumsden Point dredging were modelled by WorleyParsons using the Mike3D Mud Transport (MIKE3D MT) sediment transport model. This model was used in combination with the MIKE3D Hydrodynamic (MIKE3D HD) model, with the three-dimensional (3D) ocean/coastal circulation model tool developed by Danish Hydraulic Institute (DHI) software. The MIKE3D HD model was used to provide 3D current fields, which are the driving force for the MIKE3D MT model.

This model computes a 3D simulation of total suspended sediment (TSS) distributions and sedimentation patterns by predicting the transport, dispersion and settling of suspended sediments released into the water column during the dredge program. Wind, wave and current data were applied to the model to indicate the effects of these parameters on mobilised sediments and deposition.

The model was developed and calibrated using a range of data inputs and assumptions detailed in Table 5. The model was run for the entire period of dredging; that is, a total period of 20 weeks. The model calculated concentrations additional to background levels ('above background').

Table 5: Data inputs for dredge modelling

Description	Data inputs for model
Dredging method	The CSD would operate in a south-westerly direction, from the channel towards Lumsden Point, dredging immediately to depth along this path in each sweep.
Total volume of material to be dredged	2 Mm^3
Area to be dredged	Entrance to South and South East creeks defined by coordinates in Figure 10.
Expected dredging start	Not known
Expected duration of dredging	20 weeks
Dredging rates	1000 m^3 per hour
Particle-size distributions for all	Particle-size data was collected from geotechnical borehole data collected within the dredge footprint between depths of 0 m and 8 m.

Description	Data inputs for model
types of material to be dredged	
TSS data	Background TSS did not input to the model
Tidal data	Tide data provided by validated WorleyParsons Port Hedland hydrodynamic model
Metocean data	BN 15 Directional Wave – Nov. 2006 to Nov. 2009 Bn 15 Wind: from May 2000 to September 2011
Bathymetry	Topographical and Cadastral Map series 1999 Annual survey 2006, 2008, 2010 Nelson Point post construction survey 2010 Harriet Point post construction survey 2009 SWC post construction survey 2012
Dredge volume per day	14,400 m^3
Average hours per week of operation	100.8
Maintenance schedule (repairs, refuelling etc.)	60% efficiency

3.1.2 Scenarios modelled

To accurately define the potential impacts of dredging on water quality and thus identify indirect ecological impacts to the receiving environment, a range of outputs were developed from the model. For both modelled parameters – TSS and sediment deposition – several scenarios have been presented during the winter period (Section 5.4). The winter season was considered the worst case between each season modelled and therefore is the scenario presented in Section 5.4.

Plume modelling outputs for the summer season are also included in the technical appendix.

Modelled outputs presented for TSS in Section 5.4 include predicted SSCs for 50% of the time (50th percentile) and 20% of the time (80th percentile) during dredging activities. The 50th and 80th percentile values are considered indicative of most of the expected SSCs during the 20-week dredging campaign.

For potential impacts from sedimentation, modelled outputs have been presented in Section 6.4. Outputs include deposition rate and total thickness during dredging activities.

4. IMPACT ASSESSMENT APPROACH

The following sections describe how the potential impacts of the Lumsden Point General Cargo Facility were assessed. The management objectives for each key environmental factor were considered, along with the design, mitigation and management measures proposed to reduce the impacts and an evaluation of the significance of the residual impacts in light of the management approach.

The assessment of impacts deals with the potential impacts (those that might occur). The potential environmental impacts of both the construction and operational phases of the Lumsden Point General Cargo Facility were identified by:

- consulting with the OEPA;
- reviewing historical data for the area;
- considering the results of technical studies (hydrodynamic and plume modelling; marine sediment analysis) undertaken to inform the project's impact assessment;
- reviewing the consultation responses received; and
- assessing the impacts associated with other similar projects nearby.

Within this document, potential impacts on the key environmental factors (marine water quality and BPPH) have been identified based on the existing environment and the alteration of any physical, chemical, biological or perceived characteristic of that environment by the Lumsden Point General Cargo Facility development and operation.

Each factor addressed includes a description of the existing (baseline) environment with the potential to be affected by the project. This is followed by consideration of the potential environmental impacts that might arise from the project's construction (dredging, disposal of dredge material and reclamation) and operational phases.

Where adverse impacts may occur, methods or actions to reduce or alleviate (mitigate) those potential impacts are presented. These aim to reduce the residual impacts to an environmentally acceptable level.

The following section provides an overview of each of the identified 'key' factors including environmental objectives, baseline conditions, potential impacts, management of impacts and predicted outcomes.

The key environmental factors have been identified as:

- marine water quality; and
- BPPH.

The PHPA has also assessed other relevant environmental factors as part of the Lumsden Point General Cargo Facility in Section 7 of this referral. These factors are not expected to be significantly affected by the project and can be managed under existing regulatory frameworks.

5. IMPACT ASSESSMENT AND MANAGEMENT – MARINE WATER QUALITY

5.1 OEPA objective

As stated in EAG 8 (EPA 2013), the Marine Environmental Quality objective is:

- to maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected.

In order to maintain the quality of water so that existing and potential environmental values are protected, environmental values and environmental quality objectives set by the Department of Environment (2006) will also be used.

5.2 Policy and standards

The key guidelines relevant to the assessment and management of potential impacts to marine water quality from the Lumsden Point General Cargo Facility are:

- *Australian and New Zealand guidelines for fresh and marine water quality* (ANZECC/ARMCANZ 2000);
- *Pilbara coastal water quality consultation outcomes: environmental values and environmental quality objectives* (DoE 2006); and
- *National assessment guidelines for dredging* (NAGD) (Commonwealth of Australia 2009).

ANZECC/ARMCANZ (2000) provides guidance on determining impacts from activities with the potential to cause changes to water quality. The guidelines present a series of criteria based on levels of ecological protection for a range of contaminants within the marine environment. While the guidelines can be directly applied to marine water throughout Australia, it is recommended that where possible site-specific data should be used. Therefore in the context of the Lumsden Point General Cargo Facility, the *Pilbara coastal water quality consultation outcomes: environmental values and environmental quality objectives* (DoE 2006) have been adopted to help define potential impacts on water quality.

The former Department of Environment (now DER) completed a public consultation program that recommended a set of environmental values (EVs) (Table 6) and a set of Levels for Ecological Protection (LEPs) to be developed for Pilbara coastal waters (Table 7). The EPA has given interim approval to this environmental quality management framework for guiding environmental impact assessment and regulation.

Table 6: Pilbara coastal waters environmental values and environmental quality objectives

Ecosystem Health (ecological value)		This means maintaining the structure (e.g. the variety and quantity of life forms) and functions (e.g. the food chains and nutrient cycles) of marine ecosystems.
Recreational and Aesthetics (social use value)		Water quality is safe for recreational activities in the water (e.g. swimming).
Cultural and Spiritual (social use value)		Aesthetic values of the marine environment are protected. Cultural and spiritual values of the marine environment are protected.
Fishing and Aquaculture (social use value)		Seafood (caught or grown) is of a quality safe for eating. Water quality is suitable for aquaculture purposes.
Industrial Water Supply (social use value)		Water quality is suitable for industrial supply purposes.

Source: Pilbara coastal water quality consultation outcomes: environmental values and environmental quality objectives (DoE 2006).

Table 7: Pilbara coastal waters levels of ecological protection linked to the maintenance of ecosystem integrity

Level of Ecological Protection	Environmental quality condition (Limit of acceptable change)	
	Contaminant concentration indicators	Biological indicators
Maximum	No contaminants (pristine)	No detectable change from natural variation
High	Very low levels of contaminants	No detectable change from natural variation
Moderate	Elevated levels of contaminants	Moderate changes from natural variation
Low	High levels of contaminants	Large changes from natural variation

Source: Pilbara coastal water quality consultation outcomes: environmental values and environmental quality objectives (DoE 2006).

The Pilbara Coastal Water Quality Consultation Outcomes Environmental Values and Environmental Quality Objectives suggest using the ANZECC guidelines 90% level of ecological protection for Port Hedland Port within 250 m of existing, new and approved facilities and infrastructure (DoE 2006).

In accordance with these objectives, the 90% level of ecological protection should logically be extended to within 250m of the proposed dredge footprint and infrastructure boundary (Figure 15) as has most recently occurred for the South West Creek dredge footprint and the Small Vessel Cyclone Mooring Facility dredge footprint in Stingray Creek. All other marine environments within state waters of the Port Hedland region are suggested to fall within a 99% ecological protection level.

The NAGD provides advice on the management of sediments likely to be disturbed by dredging activities. The guidelines provide a detailed approach and method for identifying the level of environmental risk associated with dredging and disposal of sediments.

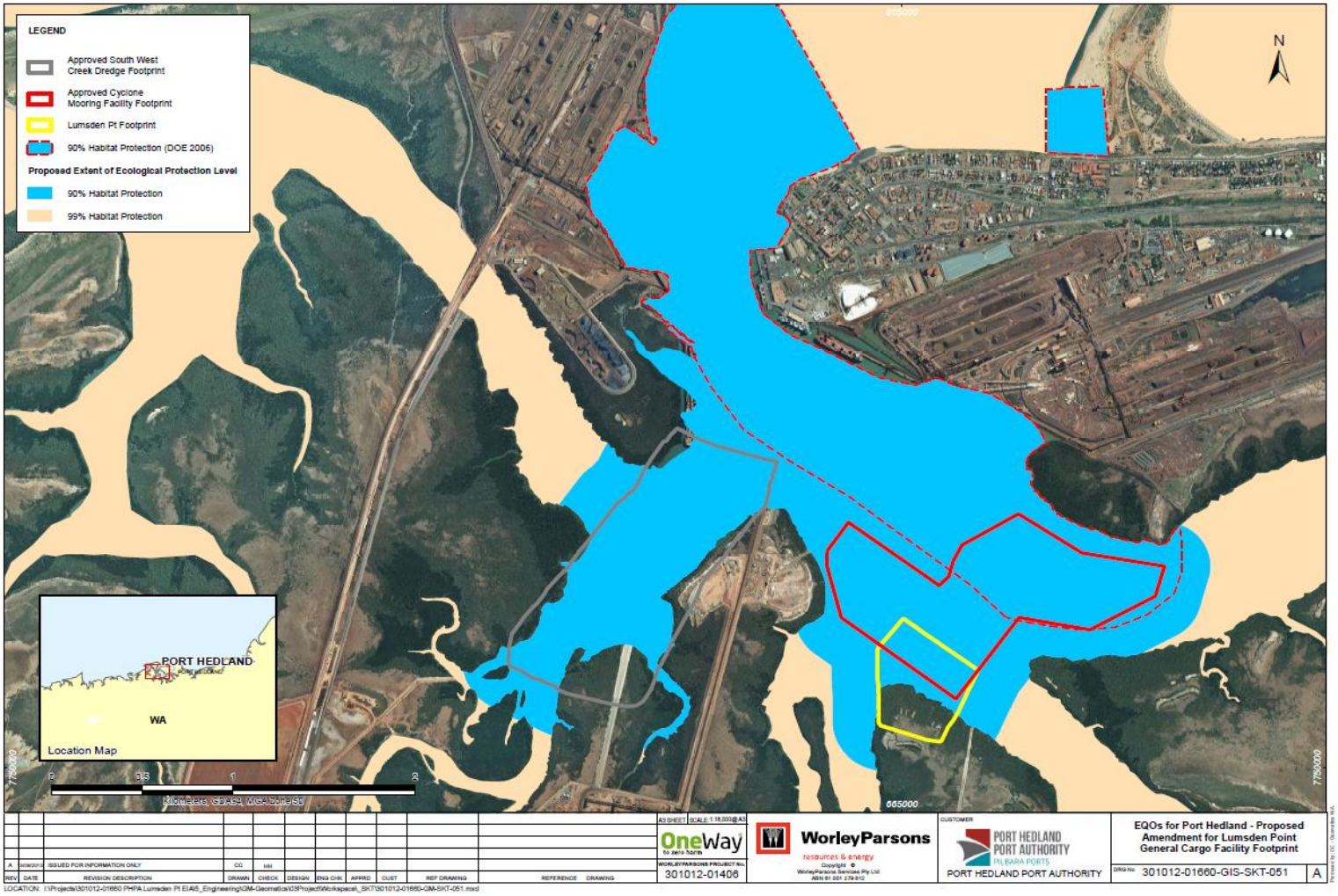


Figure 15 Proposed extension of the 90% Ecological Protection Level Boundary

5.3 Existing condition

Port Hedland inner harbour is a highly turbid environment that experiences strong currents due to the large tidal range that occurs in the area. Water quality within Port Hedland port limits exhibits substantial physical and chemical variation due to substantial tidal inflows, as well as catchment runoff and port activity following sporadic freshwater inflows. Water quality is likely to be affected on a continuous basis by the following activities:

- deposition of iron ore dust from ship loading activities;
- leaching of antifouling contaminants from ship hulls through mechanical abrasion against seabed and wharf infrastructure;
- mobilisation of sediments from propeller wash, dredging and dewatering activities;
- runoff from port infrastructure; and
- dredging activities.

Several baseline water quality investigations have already been undertaken within port limits, often in response to environmental management requirements before the start of capital dredging and reclamation activities (WorleyParsons 2012c) and also during dredging as part of compliance monitoring.

5.3.1 Physico-chemical water quality

Due to the rapid and continuous expansion of port infrastructure in recent years, water quality throughout the inner port has been affected by dredging activities – resulting in extended periods of increased turbidity and SSCs. This has also made the collection of baseline water quality data challenging as sites shown in Figure 13 have been used as both reference and impact sites during previous dredging projects inside the harbour.

The most relevant recent study undertaken to define baseline physico-chemical water quality was in 2012 for the Stingray Creek Cyclone Mooring Facility, with additional parameter data from the BHPBIO Hunt Point Dredging Project in 2012 and the South West Creek Dredging and Reclamation Project (PHPA 2011; BHPBIO 2012; WorleyParsons 2012c).

Baseline monitoring was also undertaken at a discharge point in South Creek (SCD) for the South West Creek Dredging and Reclamation Project in 2011 (WorleyParsons 2011b). A timeline for the period in which baseline water quality data was collected is given in Table 8. A map showing the location of each site is shown in Figure 16. Turbidity, pH, temperature, dissolved oxygen and salinity were recorded at SWC, SEC and FIC, while only turbidity was recorded at SRC in accordance with project specific requirements.

Table 8: Baseline data collection periods from four sites located within the inner harbour

Site	Period of data collection
SWC	08/01/11 - 21/01/11
SEC	1/12/10 - 23/02/12
FIC	19/01/12 – 28/03/12
SRC	14/02/11 – 23/02/12
SCD	11/06/11 – 22/09/11

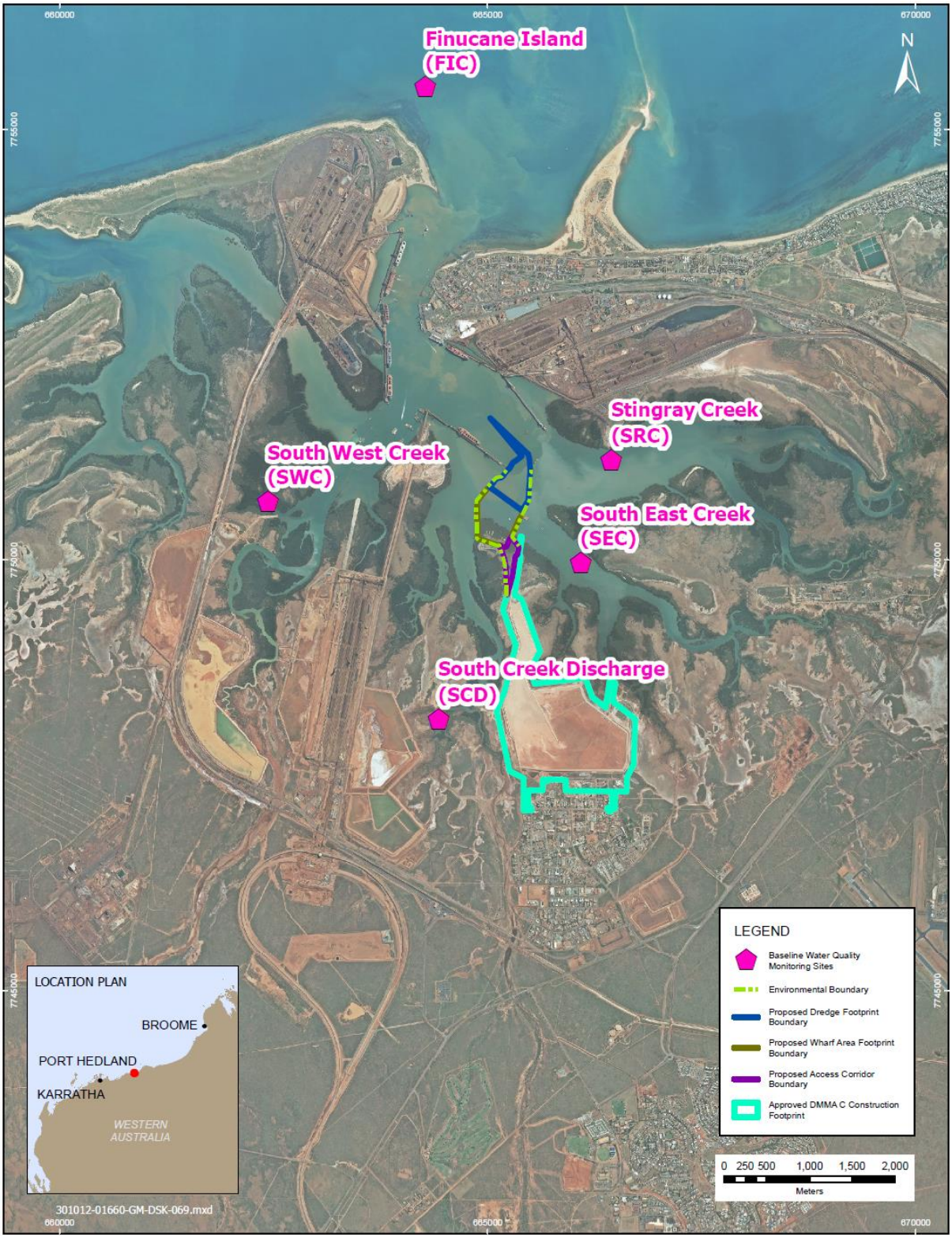


Figure 16: Baseline water quality monitoring sites (used during previous dredging projects)

The turbidity at the entrance to South East Creek (SEC) and Stingray Creek (SRC) adjacent to the proposed dredging footprint can be considered generally low (median is <10 NTU), with small variations observed between neap and spring tidal cycles. The low turbidity regime is likely a consequence of increased flushing from cleaner waters that flow into the inner harbour during flood tides. Monitoring undertaken at sites located at the entrance to SEC and SRC calculated an 80th percentile of 11.1 NTU and 10.6 NTU respectively.

In SWC, which is located to the west of the Lumsden Point General Cargo Facility, water quality is generally considered to be more turbid due to the reduced flushing of ocean seawater and higher levels of mobilised sediments that are generated from strong tidal currents in this narrow creek during ebb and flood tides. The data also showed a strong relationship between neap and spring tidal periods, with elevated turbidity levels displayed during spring tides compared with neap tides. Higher turbidity levels are also shown between the high and low tides due to higher volumes of sediment that remain suspended in the water column. This becomes more pronounced during spring tide events (Table 9).

Turbidity recorded from Finucane Island (FIC), which is located at the entrance to inner harbour displayed a median of turbidity of 10.3 NTU. Given the seaward location of FIC, the turbidity regime identified here would be expected to be similar to or lower than SRC and SEC. It is likely the shallow bathymetry and strong current observed in this area would promote the mobilisation of sediments, causing an increase in turbidity (Table 9).

Within South Creek at the former discharge site SCD, the turbidity displayed a median of 12.3 NTU. Shallow bathymetry and strong currents due to tides here would also promote the mobilisation of sediments, causing a higher turbidity than sites at the entrance of the creeks (Table 9).

Table 9: Summary of turbidity (NTU) recorded at four sites within Port Hedland inner harbour during baseline conditions

Site	N	Mean	Std Dev	Median	80th %ile	95th %ile	99th %ile
SRC	12986	8.4	9.7	4.2	10.6	30.7	41.1
SEC	19035	9.4	20.6	6.7	11.1	20.1	52.2
FIC	3285	13.90	12.88	10.30	20.6	36.1	60.7
SWC	541	14.2	9.1	11.7	18.3	29.9	53.1
SCD	4704	12.3	14.28	9.4	15.9	24.7	57.8

The pH was found to be similar between FIC, SEC and SCD. A median of 8.11 and 8.24 was calculated at FIC and SEC, while 7.96 was recorded at SCD. A lower median pH of 7.63 was calculated from SWC compared with other sites. The pH was found to show low variation at each site (Table 10).

Table 10: Summary of pH recorded at four sites within Port Hedland inner harbour during baseline conditions

Site	N	Mean	Std Dev	Median	80th %ile	95th %ile	99th %ile
SEC	26034	8.18	0.49	8.24	8.645	8.74	8.79
FIC	28	8.11	0.00	8.11	8.11	8.11	8.12
SWC	451	7.67	0.18	7.63	7.88	7.95	7.96
SCD	4626	7.96	0.15	7.94	8.13	8.54	8.59

Due to the shallow bathymetry observed at each site, temperature was found to vary depending on air temperature variation as a consequence of seasonal change. Median temperatures at each site ranged between 21.21 °C and 31.63 °C (Table 11). Temperatures were generally relatively high due to the sub-tropical climate that is found in this region of Australia. SCD baseline data was collected generally during the cooler months as opposed to the other sites, and hence show a slightly lower median temperature.

Table 11: Summary of temperature (°C) recorded at four sites within Port Hedland inner harbour during baseline conditions

Site	N	Mean	Std Dev	Median	80th %ile	95th %ile	99th %ile
SEC	26263	27.42	4.20	28.92	31.12	32.21	33.09
FIC	31	29.60	0.66	29.39	29.70	30.65	32.06
SWC	451	31.71	1.14	31.63	32.69	33.8	34.33
SCD	4918	21.21	2.28	21.21	23.08	25.18	26.42

FIC displayed the highest median dissolved oxygen concentration compared with the other sites within the inner harbour. Increased flushing from wave action and exposure to the open ocean would likely promote increased saturation of oxygen into the water column at this site. SWC displayed the lowest dissolved oxygen regime (Table 12).

Table 12: Summary of dissolved oxygen (% saturation) recorded at four sites within Port Hedland inner harbour during baseline conditions

Site	N	Mean	Std Dev	Median	80th %ile	95th %ile	99th %ile
SEC	22887	76.3	15.7	80.4	89.9	96.4	102.8
FIC	31	98.7	2.5	98.0	99.6	103.2	106.7
SWC	451	74.0	18.1	72.4	90.6	104.8	108.7

SCD	4626	87.48	9.13	88.27	94.70	100.56	106.66

Salinity levels were mostly typical of seawater. Low freshwater inputs within the inner harbour's creek systems cause salinity levels to remain relatively constant. Salinity observed at FIC was lower compared with SEC and SWC (Table 13). The high evaporation rates (particularly during summer) within the intertidal creek areas generally cause salinity levels to increase within the creek systems during an ebb tide. This was particularly evident in the SCD salinity results which were higher than that at other sites.

Table 13: Summary of salinity (ppt) recorded at four sites within Port Hedland inner harbour during baseline conditions

Site	N	Mean	Std Dev	Median	80th %ile	95th %ile	99th %ile
SEC	25101	36.5	1.8	36.8	37.8	39.0	40.0
FIC	28	35.4	0.1	35.4	35.4	35.5	35.5
SWC	451	37.5	1.1	37.4	38.5	39.7	40.3

5.3.2 Chemical water quality

Baseline water quality investigations undertaken in South West Creek as part of the PHPA's dredging and reclamation project (WorleyParsons 2010f) found that all metals reported concentrations below (ANZECC/ARMCANZ 2000) for 99% ecological protection, with the exception of copper and cobalt due to the laboratory limit of reporting being above the (ANZECC/ARMCANZ 2000) guidelines. Nutrients and hydrocarbons in the same study were below the 99% level of ecological protection guidelines at the monitored sites.

Baseline water quality investigations for RGP5 and RGP6 were undertaken between August 2008 and December 2009. All parameters reported concentrations below ANZECC & ARMCANZ guidelines (2000) for 99% ecological protection, with the exception of copper, cobalt zinc and nickel. Copper, zinc and cobalt exceeded the 95% species protection (ANZECC/ARMCANZ 2000) trigger values and nickel exceeded the 99% species protection (ANZECC/ARMCANZ 2000) trigger value (BHPBIO 2010).

More recently, as part of the South West Creek dredging project, nickel concentrations in return water were monitored during dewatering activities. The monitoring program measured intermittent exceedances in of the trigger value for nickel (7 µg/L) however similar exceedances were noted in reference areas unaffected by dredging (WorleyParsons 2012b)

In the High Ecological Protection Area (HEPA) a 99% species protection is adopted and in the Moderate Ecological Protection Area (MEPA) a 90% species protection is adopted. The species protection values for certain contaminants are designated according to the ecological protection area (ANZECC/ARMCANZ 2000) as shown in Figure 14.

5.4 Potential impacts

5.4.1 Turbidity generated from dredging activities

Generation of turbid plumes during dredging and dewatering activities have the potential to affect a range of environmental receptors. Increases in turbidity caused by dredging using a cutter suction dredge are usually associated with the displacement of sediments by their physical removal from the seabed and the mixing of fine sediments, with excess water collected during transfer of sediments to the hopper barge (for transport to the disposal ground). Other significant sources of turbidity can be propeller wash as the dredge vessel movement within the dredge footprint.

The maximum SSC predicted 20% of the time (80th percentile) is 200 mg/L within the proposed dredge footprint. SSC predicted immediately outside of the dredge footprint ranged between 40 mg/L and 200 mg/L. The highest concentrations outside the dredge footprint were observed in South East Creek with concentrations up to 200 mg/L. Concentrations of between 30 mg/L and 50 mg/L were observed in the mouth of South West Creek, throughout South Creek and in the mouth of Stingray Creek. The maximum spread (80th percentile) of the sediment plume (>20 SSC/mg/L) is predicted throughout the inner harbour extending to the entrance and up to the furthest point in each of the five creek systems (Figure 17).

The maximum SSC predicted to be exceeded 50% of the time (50th percentile) is 100 mg/L within the proposed dredge footprint. SSC immediately outside of the dredge footprint ranged between 20 mg/L and 100 mg/L. The highest SSCs outside the dredge footprint were observed in South East Creek with concentrations up to 100 mg/L. The maximum spread (50th percentile) of the sediment plume (>20 SSC/mg/L) is predicted in the mouth of South and Stingray Creeks (Figure 18).

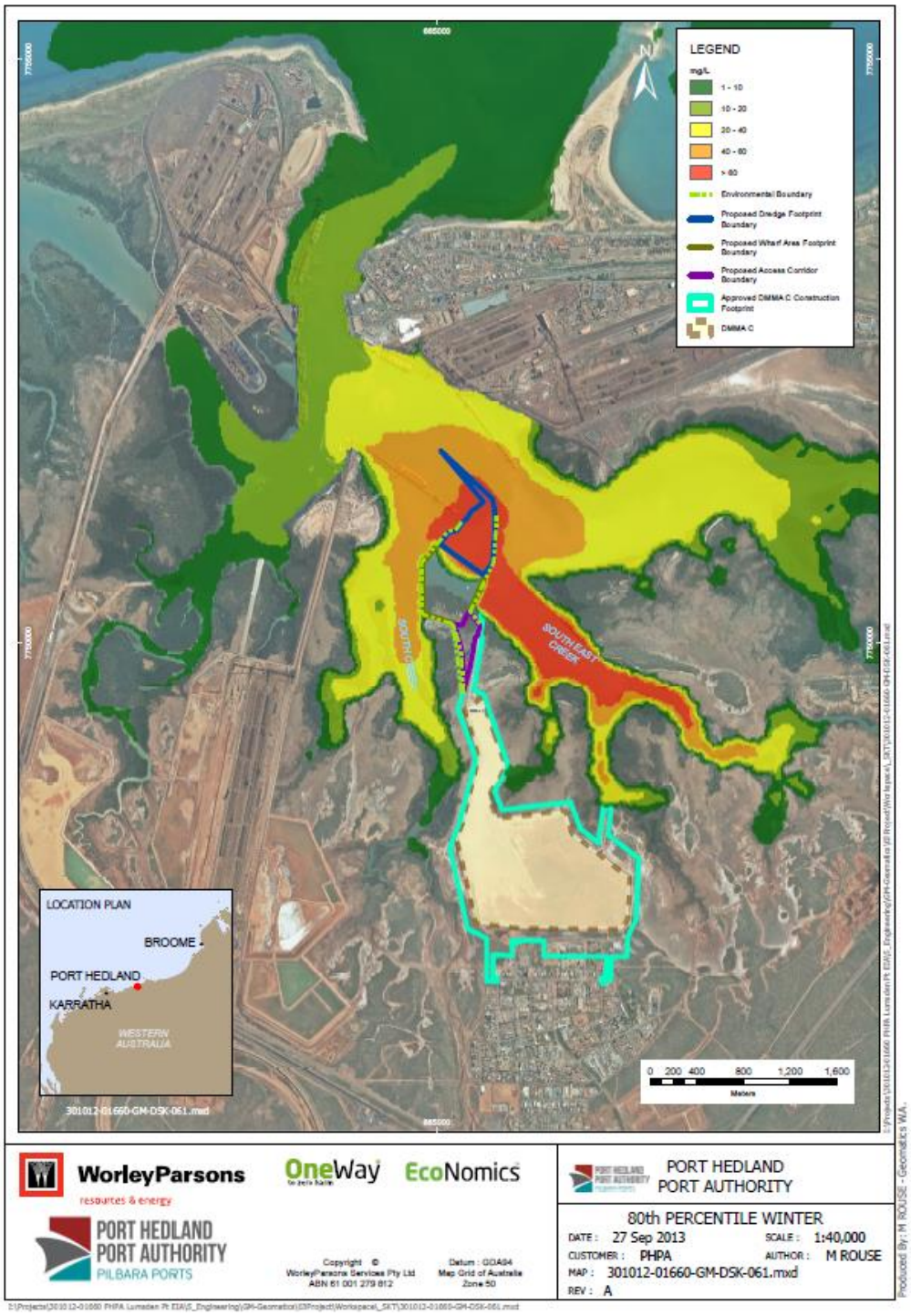


Figure 17: Predicted (80th percentile) suspended sediment concentrations (above background) during dredging

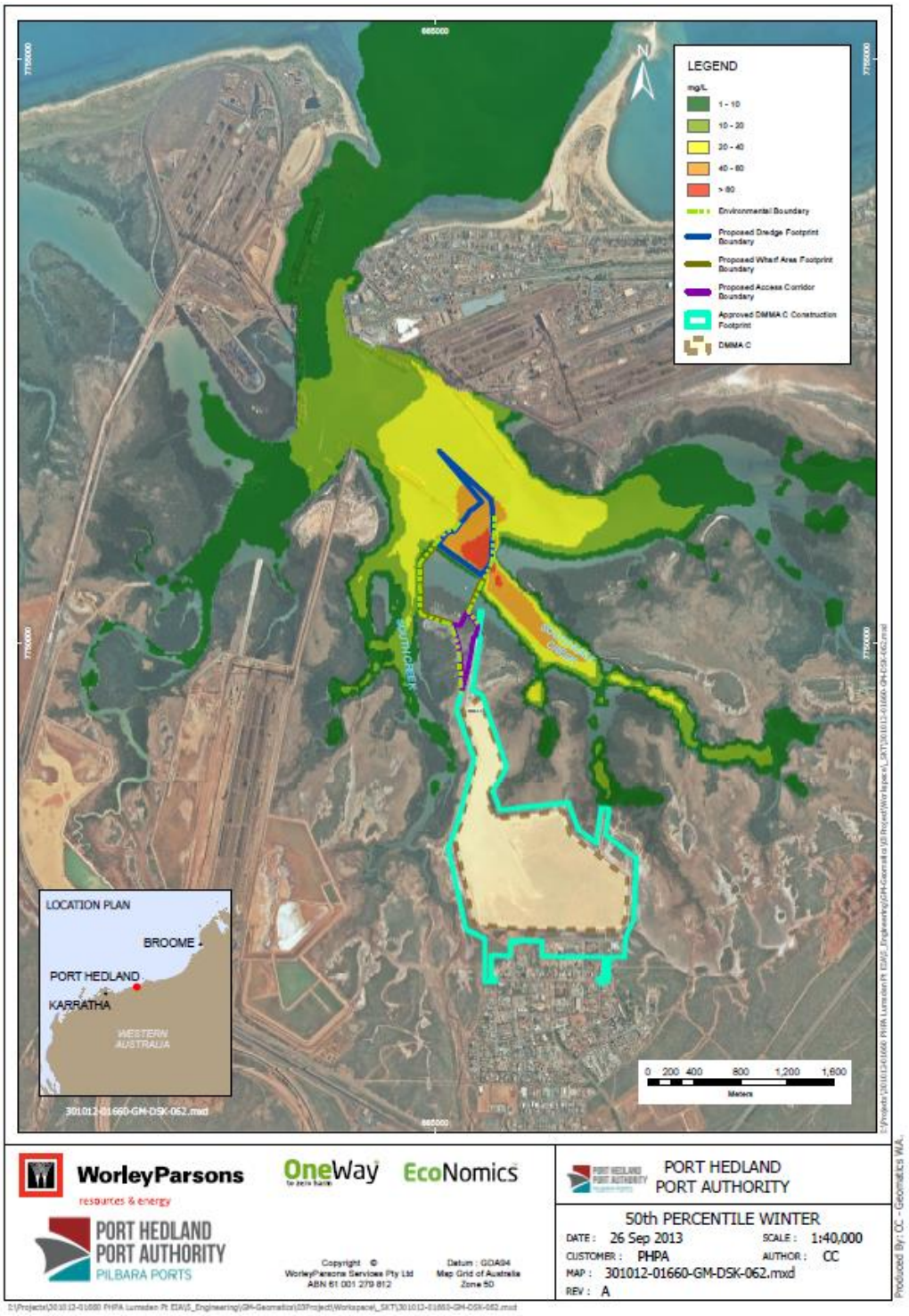


Figure 18: Predicted (50th percentile) suspended sediment concentrations (above background) during dredging

5.4.2 Mobilisation of contaminants and acid generation during dredging and disposal

A detailed sediment quality assessment was undertaken in the Lumsden Point General Cargo Facility dredge footprint (Appendix 2 and Appendix 6). Contaminant concentrations for a suite of parameters were all below adopted guideline NAGD screening levels with the exception of nickel and chromium. These two metals have both been found to occur at naturally elevated concentrations throughout the Port Hedland region (DEC 2006a). Contaminants bound to sediments can become dissolved in the water column following disturbance during dredging activities. If contaminant concentrations exceed threshold criteria, toxic impacts on species exposed to the elevated concentrations may occur. The return water from any dredge material relocated from DMMA C into DMMA B-North will be discharged via the proposed DMMA B North discharge channel into South Creek.

The sediment quality assessment undertaken as part of the project has also confirmed that contaminant concentrations are very low and well below screening levels. Although levels of nickel and chromium were marginally exceeded in some individual samples, the overall dredged material was classified as clean and suitable for disposal onshore (WorleyParsons 2013b). More detail is provided in Appendix 6.

Acid sulfate soil (ASS) tests were also undertaken on sediments located within the proposed dredge footprint. The potential for ASS was found in three of the tested samples collected from surface sediments, however due to the increased neutralising capacity from the calcareous materials, no samples exceeded the DEC (DEC 2013) Action Criteria for net acidity – requiring no active ASS management measures to be implemented (WorleyParsons 2013b).

5.5 Management

The management, monitoring and reporting procedures to be followed during construction are summarised below and presented in the CDMP (see Appendix 1).

Water quality will be monitored at various locations that may be affected by the generation of sediment plumes (impact sites) and at reference sites. The site locations were chosen close to coral communities potentially sensitive to changes in water quality. They are also all within the DoE (2006) recommended zone of high level of ecological protection, so that the environmental quality conditions (low levels of contaminants and no detectable change from natural variation (Table 5)) can be monitored. Should monitoring at the impact and reference sites identify that changes to water quality resulting from dredging activities may potentially affect the area's EVs, a management action plan detailed in the tiered management framework (Section 7.1 of the CDMP) will be implemented.

Full details of the management measures and monitoring program to mitigate water quality impacts are detailed in Section 7.2 of the CDMP.

5.6 Predicted outcome

No increase in TSS or contaminant concentrations from the construction and dredging activities of the Lumsden Point General Cargo Facility are predicted to affect the EVs of the region.

6. IMPACT ASSESSMENT AND MANAGEMENT – BENTHIC PRIMARY PRODUCER HABITAT

BPPs are species found on the seabed that use light for photosynthesis. These species include marine plants such as macroalgae, seagrasses, mangroves, turf algae and benthic microalgae, as well as the scleractinian corals that contain zooxanthellae and photosynthesising bacteria that enable them to extract energy from sunlight.

BPPs are considered to have an important ecological role in the marine environment. They not only capture energy and release nutrients into the marine environment but also provide a food source, shelter and habitat for a range of other species.

6.1 OEPA objective

The environmental objective given by the OEPA (EAG 8) for Benthic Communities and Habitat is:

- to maintain the structure function, diversity, distribution and viability of benthic communities and habitats at local and regional scales

6.2 Policy and standards

The key guidelines relevant to the assessment and management of potential impacts to BPPH from the Lumsden Point General Cargo Facility are:

- EAG 3: *Protection of benthic primary producer habitats in Western Australia's marine environment* – provides guidance on assessing potential impacts, including cumulative irreversible loss and serious damage to BPPHs in Western Australia's marine environment; and
- EAG 7: *Marine dredging proposals* – designed to impart clarity and consistency to the information presented to the EPA for the environmental impact assessment of marine dredging proposals through the provision of a single assessment framework.

Further details on the implications of both guideline statements listed above with respect to the project has been provided in Section 1.3 of the *Ecosystem Impact Assessment and Cumulative Impact Assessment* report (Appendix 5).

6.3 Existing BPPH

The marine habitats found in Port Hedland are characteristic of those found along the arid coastlines of the Pilbara. Typically, dense stands of mangroves occupy areas within the intertidal zone, where tidal inundation is sufficiently frequent to maintain adequate sediment water content and levels of salinity for colonisation by mangroves. As distance from the shoreline increases, the height and cover of mangrove vegetation decreases, giving way to saltmarsh (samphire) and bare tidal flats as sediments become dryer and more saline (Saenger 2002). Some areas between the mangrove- and samphire-dominated habitats of the

upper intertidal zone support cyanobacterial mats under suitable conditions (Paling, McComb et al. 1989; Paling, Humphries et al. 2003).

Most subtidal benthic habitats within Port Hedland harbour are characterised by unvegetated substrate (78.77%), with sparse patches of turf algae, small foliaceous macroalgae and sessile filter-feeding invertebrates (WorleyParsons 2012a). Habitats supporting coral communities are sparsely distributed and do not represent a high percentage cover across the inner harbour (0.09% cover). A canopy algae community comprising *Sargassum* sp. exists in dense patches in the eastern parts of Stingray Creek. No seagrass communities have been found in the harbour.

A recent benthic habitat survey undertaken within the Lumsden Point General Cargo Facility footprint identified supratidal, intertidal and subtidal habitats (Appendix 3). It was generally found that the subtidal and non-mangrove intertidal benthic communities within the Lumsden Point General Cargo Facility footprint comprised a mosaic of turfing algae and macroalgae, interspersed by large areas of bare substrate. These habitats are considered typical of those found at the mouths of the creek systems surrounding the inner port area, with bare substrate and turfing algae generally the most dominant habitat types (WorleyParsons 2010b; WorleyParsons 2011a). Turfing algae appeared to be more prevalent in the deeper subtidal areas, which are subject to less influence from tidal drying than the shallow banks at the mouths of creeks. Such species are likely to rapidly recolonise suitable areas within the harbour in the event of disturbance. Furthermore, significant seasonal change in canopy algae coverage is known to occur in Port Hedland harbour, with large algal blooms occurring in association with the wet season (WorleyParsons 2010b).

The mangrove community structure encased three of the seven known species of mangroves within the Port Hedland area. The predominant species across the disturbance footprint was *Avicennia marina*, which was found in all vegetated areas. Tree density data showed that 77.34% of the disturbance footprint is dense, thickly grown vegetation. This trend coincides with vegetation complexes closer to the waterline showing greater density than those farther away. No unusual or unique habitat complexes were found, with all supratidal mangrove habitats within the disturbance footprint and fringing area considered typical of those found in the surrounding creek systems of Port Hedland (WorleyParsons 2010b).

6.4 Potential impacts

A detailed assessment of potential and predicted impacts from the Lumsden Point General Cargo Facility on mangrove communities and other BPPs within the inner harbour area is provided in Appendix 5. This section summarises the potential impacts to BPPHs in and around the proposed dredge footprint, the possible risks to the short- and long-term condition of these habitats and proposed mitigation measures and monitoring.

6.4.1 Direct disturbance

Direct loss of BPPH will occur within the Lumsden Point General Cargo Facility footprint due to the removal of substrates via dredging and construction, and the placement of material within the wharf and access corridor.

The total maximum area of each BPPH type that stands to be lost from completion of the PHPA's General Cargo Facility at Lumsden Point is summarised in Table 14. The disturbance footprint includes mangrove habitat and bare substrate. Bare substrate already dredged due to previous projects has been assumed not to include BPPH and is not included in the calculations for this project. Areas approved for disturbance for the PHPA Cyclone Mooring Project are also not included as they have already been accounted for as benthic habitat loss (WorleyParsons 2011a). Within the zones not previously approved for disturbance, mangroves (and associated pneumatophores) and bare substrate were the habitats identified. Bare substrate in the benthic zone covered 8.34 ha and is potential benthic microalgal habitat. This results in a loss of 0.36% of the benthic microalgal habitat present within the LAU, which leads to a cumulative loss of 11.36%. Mangrove habitat to be cleared has been proposed to be a maximum of 13.88 ha, or 0.52% of the mangrove habitat within the LAU and a cumulative loss of 14.57%. None of the 22.22 ha of BPPH is considered unique or rare within the Port Hedland locality and all types of BPP are well represented in neighbouring and adjacent areas within the Port Hedland LAU.

Table 14: Maximum BPPH loss from the Lumsden Point General Cargo Facility footprints

Habitat Type	Footprint (ha)					
	Wharf area	Access corridor	North pipeline corridor	South pipeline corridor	DMMA B-North discharge channel	Total
Mangroves	8.86	4.79	0.19	0	0.04	**13.88**
Bare Substrate	5.85	1.82	0.27	0.33	0.07	**8.34**
Total BPPH	**14.71**	**6.61**	**0.46**	**0.33**	**0.11**	**22.22**

*Note: Mangrove loss includes each identified community type, density and area covered by pneumatophores

Within EAG 3, cumulative loss guidelines for benthic primary producer habitat within defined local assessment units for six categories of marine ecological protection are considered. Associated with these are cumulative loss guidelines, which are tools to identify the risk to ecological integrity based on the cumulative loss within the area. According to these categories, a development area (e.g. port operational area) such as Port Hedland would be in Category E, and has a cumulative loss guideline of 10%. However, the Port Hedland LAU has had BPPH losses over 10% in each of the habitat types except for corals.

The estimated areas of BPPH directly affected by these activities with respect to the cumulative loss of BPPH within the Port Hedland LAU are summarised in Table 15.

Table 15: Summary of estimated BPPH loss within Port Hedland LAU

Benthic habitat category	% loss of habitat category within LAU due to the Project	Estimated cumulative Loss within LAU (%)
Bare substrate (benthic microalgal) habitat	0.36	11.36
Mangroves (and associated pneumatophores)	0.52	14.57

No other direct or indirect losses are expected to be associated with the Lumsden Point General Cargo Facility.

While cumulative loss estimates exceed 10% for all BPPH, the Port Hedland LAU is considered an industrial zone where substantial anthropogenic activities and development are being undertaken on a continual basis. In addition, the benthic habitats predicted to be lost because of the proposal are not considered unusual, unique or part of a significant habitat complex. The direct loss of BPPH associated with this project also represents a very small fraction of the current total BPPH found in Port Hedland and therefore the ecological significance of estimated benthic community losses can be considered minimal.

The PHPA also has an ongoing mangrove rehabilitation program Figure 20 which is investigating methods to rehabilitate mangrove habitats and potentially lower cumulative loss. The assessment of losses presented here recognises the dynamic nature of the BPPH in the Port Hedland LAU. As such gross losses are calculated by summing the direct footprints of approved project footprints, in reality good management means actual project attributable losses are likely to be less than that approved. In addition the LAU is a geomorphically accreting system, providing more suitable mangrove habitat which is propagating mangroves. Should net loss of mangrove communities be used rather than gross loss, it would likely represent around 5% mangrove loss (WorleyParsons 2010e). This indicates a far lower ecological impact to ecosystems in a like for like biosphere.

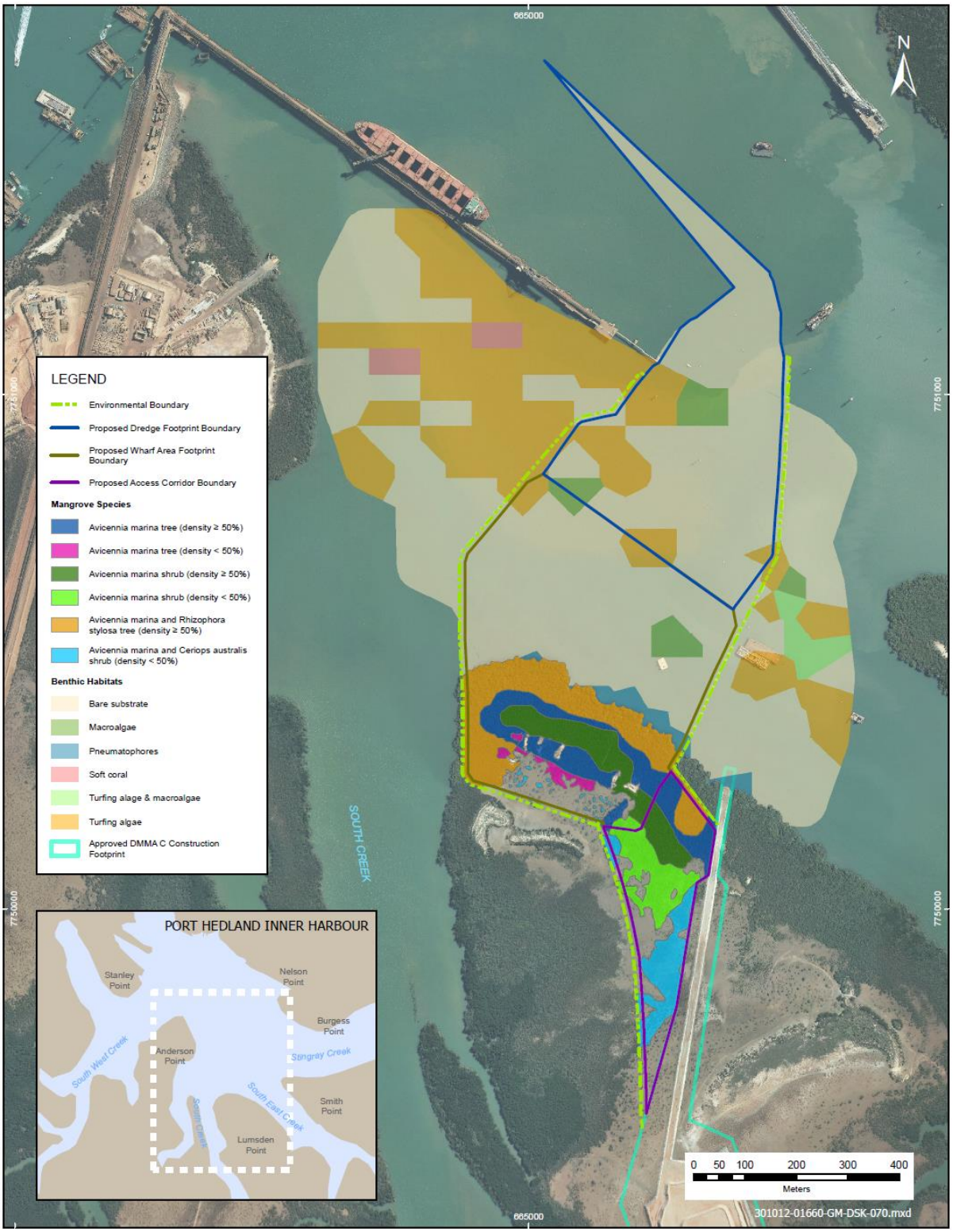


Figure 19: Benthic primary producer habitat within Lumsden Point General Cargo Facility footprint area

Figure 20: Nursery and rehabilitation area for mangroves being implemented by the PHPA

6.4.2 Zones of Impact

The impacts associated with turbidity and sedimentation effects were interpreted using spatially defined boundary extents for the Zone of High Impact (ZoHI), Zone of Moderate Impact (ZoMI) and Zone of Influence (ZoI) in accordance with Environmental Assessment Guideline for Marine Dredging Proposals No.7 (EPA, 2011) as shown in Figure 20.

The three zones defined below are the:

- Zone of High Impact (ZoHI) - The area where impacts on benthic organisms are predicted to be irreversible and where the habitat is incapable of returning to its original state. For this project, the ZoHI includes the footprint associated with the reclamation and the dredging of the swing basin immediately adjacent to the reclamation area.
- Zone of Moderate Impact (ZoMI) - The area within which predicted impacts on benthic organisms are sub-lethal, and/or the impacts are recoverable within a period of five years following completion of the dredging activities. The ZoMI abuts, and lies immediately outside of, the Zone of High Impact. For this project, the ZoMI is an area equivalent to a buffer zone around the zone of high impact.
- Zone of Influence (ZoI) - The area within which changes in environmental quality (e.g. suspended sediment levels) associated with dredge plumes are predicted and anticipated during the dredging operations, but these changes would not result in a detectible impact on benthic biota. The outer boundary of the Zone of Influence encompasses all of the predicted maximum extents of dredge plumes and represents the point beyond which dredge-generated plumes should not be discernible from background conditions at any stage during the dredging campaign. While these areas can be very large, at any point in time dredge plumes are likely to be restricted to a relatively small portion of the Zone of Influence

The ZoHI is to be confined to the area of dredging for the swing basin and construction of the reclamation area. The loss of habitat associated with the dredging is not considered significant as the seabed has existing ministerial approval to be disturbed. The reclamation will result in the permanent loss of 14.7 ha of existing marine habitat.

The ZoMI is confined to buffer zone around the zone of high impact. Based on the modelling of turbidity and sedimentation, there is very little likelihood that mangroves or other benthic primary producers will be impacted beyond the ZoMI. These predictions are based on previous experience and extensive monitoring of these habitats as part of previous dredging assessments within Port Hedland.

The ZoI has been defined as the area where a TSS threshold of 5 mg/L is exceeded for more than 50% of the time. Water quality data from a range of sites within the harbour confirm that TSS (and turbidity) is naturally high and that 5 mg/L is a much more realistic concentration than 1 or 2 mg/L in trying to discern a visible plume. The CDMP for the project proposes monitoring at a number of sites across the ZoI and in close proximity to the ZoMI to demonstrate that impacts are not greater than predicted in these zones.

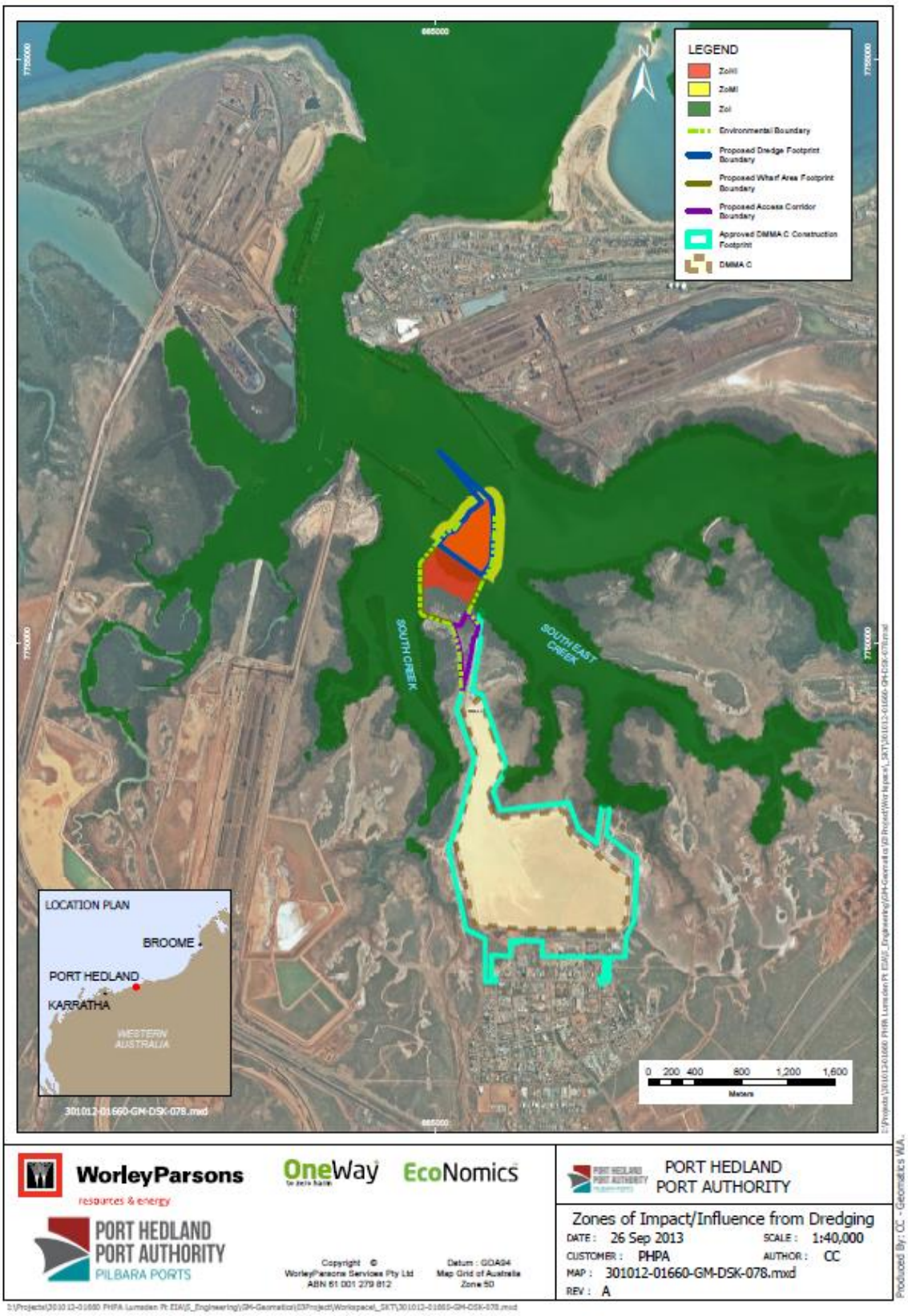


Figure 21: Predicted zones of impact and zones of influence

6.4.3 Turbidity generated during dredging activities

During dredging, increases in turbidity can cause light attenuation at the seabed. This can limit the ability of species to photosynthesise and a commensurate decrease in available energy that could otherwise be used for growth, survival and/or reproduction. Increased turbidity may also affect the behaviour and foraging efficiency of mobile marine fauna that depend on sight for feeding and/or navigation, such as some species of fish, marine turtles and marine mammals.

In an attempt to understand light irradiance at the seabed and its effects on BPPH within the inner harbour, a mathematical model of light attenuation was undertaken using results from predictive modelling from previous projects (WorleyParsons 2010e) and the modelling undertaken for the current project (Appendix 5). While the impacts from dredging activities on water quality are derived from predictive modelling, the approach indicates how tolerant BPPs within the inner harbour are to increases in turbidity from dredging activities.

The underwater light environment during the growing season is the most important period that determines the survival and productivity of BPPs (Lemmon, Gee et al. 1979; Carter 1987; Bureau of Meteorology 2010). The amount of light needed for growth and reproduction is the cumulative light received during the growth period of the BPPs' life history. Light levels below the minimum physiological requirement leads to the loss of BPPs dependent on the BPP physiological requirement[2].

Water quality monitoring undertaken within the inner harbour has determined SSC baseline values which will be utilised in this assessment across all sites (WorleyParsons 2010d). Sites are illustrated in Figure 22 and represent the key BPPs established during the baseline survey (WorleyParsons 2010c).

Estimates of the light extinction coefficient from the median values of TSS and Chl-a at each of the BPP monitoring locations are illustrated in Figure 23. Seasonal variations in TSS and Chl-a were not assessed due statistics showing there were no significant differences ($P<0.05$) between seasons (WorleyParsons 2010d).

[2] The physiological requirement for a number of the species present is not known. This assessment looks at baseline compared with modelled worst case scenarios.

Figure 22: Locations for light penetration assessments

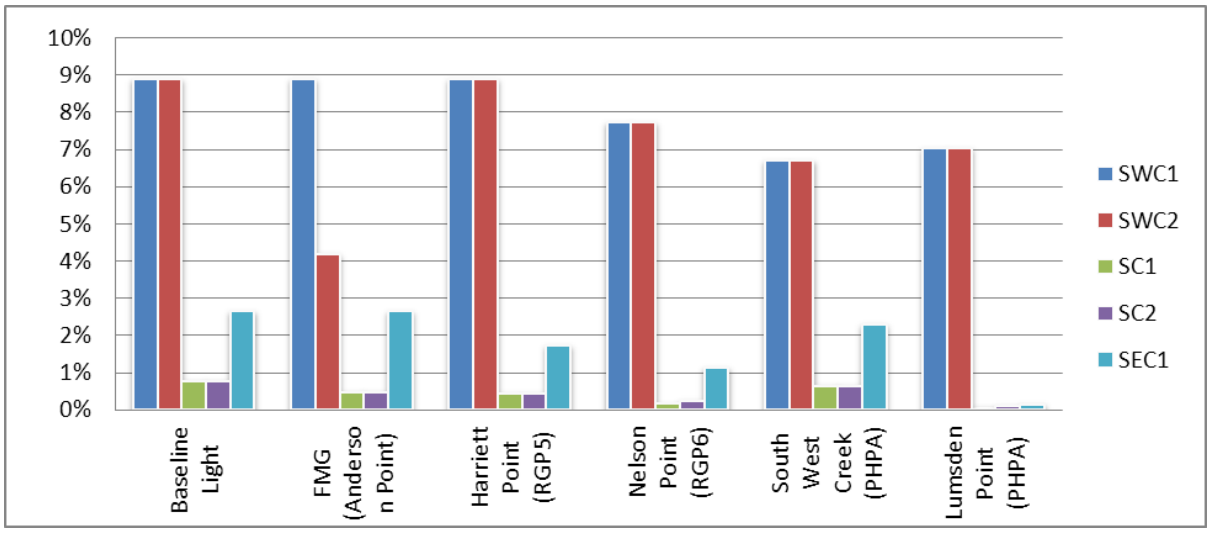


Figure 23: Percentage of surface irradiance at BPPH locations from predictive modelling from previous major dredging campaigns

As shown in Figure 23, altered light regimes due to dredging activities are low in relation to previously encountered light regimes (both natural and from previous dredging) and would be considered short and episodic. Particularly at SC1, SC2 and SEC1, light levels are already low and since communities have survived such low levels, it can be reasonably assumed they

will also survive/recover from this disturbance, which is a shorter construction campaign than the others presented in Figure 23.

Minimal light requirements of corals range from less than 1% to as much as 60% of surface irradiance (Erftemeijer 2012). Based on the values shown in Figure 23, corals that occur in Stingray Creek (SC) are already accustomed to low levels of light and are currently surviving on less than 1% surface irradiance. Similarly, corals that are present in SEC are presently surviving on less than 3% surface irradiance. Dredge plume modelling indicates that both locations are likely to experience reduced light for the duration of the dredging program in the order of less than 1% surface irradiance.

6.4.4 Impacts to BPPH from sedimentation caused by dredging

As turbid plumes migrate from the point of disturbance, sedimentation can occur in areas that experience reduced current flow as sediments fall out of suspension due to gravity. Coarser fractions generally settle out within a shorter period compared with finer fractions because of differences in particle density. Increases in sedimentation can physically smother organisms and thus reduce the amount of light being captured by BPPs at the seabed, or restrict the organisms from undertaking activities crucial for their survival.

Sediment plume modelling undertaken to predict sedimentation rates during dredging activities indicates sedimentation thickness levels between 2 mm and 200 mm. The maximum levels of sedimentation predicted outside the dredge footprint are observed within the main channel of the inner harbour and within South East Creek (between 2 mm and 75 mm) (Figure 24). Based on the current benthic habitat map, mangrove communities on the banks of South Creek are likely to experience a sediment increase of up to 5 mm, while in South East Creek an increase of up to 10 mm is predicted. Other BPPs predicted to be exposed to sediment levels up to 20 mm include a small coral community in South East Creek and the entrance to Stingray Creek and patches of turfing algae and macroalgae found throughout the inner harbour.

Considering BPPH communities have survived turbidity and sedimentation effects from previous, much larger dredging projects (that also affected much larger areas) there is a high degree of confidence that the Lumsden Point General Cargo Facility will not result in significant impacts to BPPH. The 20 week dredging campaign is also much shorter than previous dredging campaigns providing additional assurance that the Lumsden Point General Cargo Facility will have limited potential to impact on BPPH or the environmental values within the inner harbour of Port Hedland.

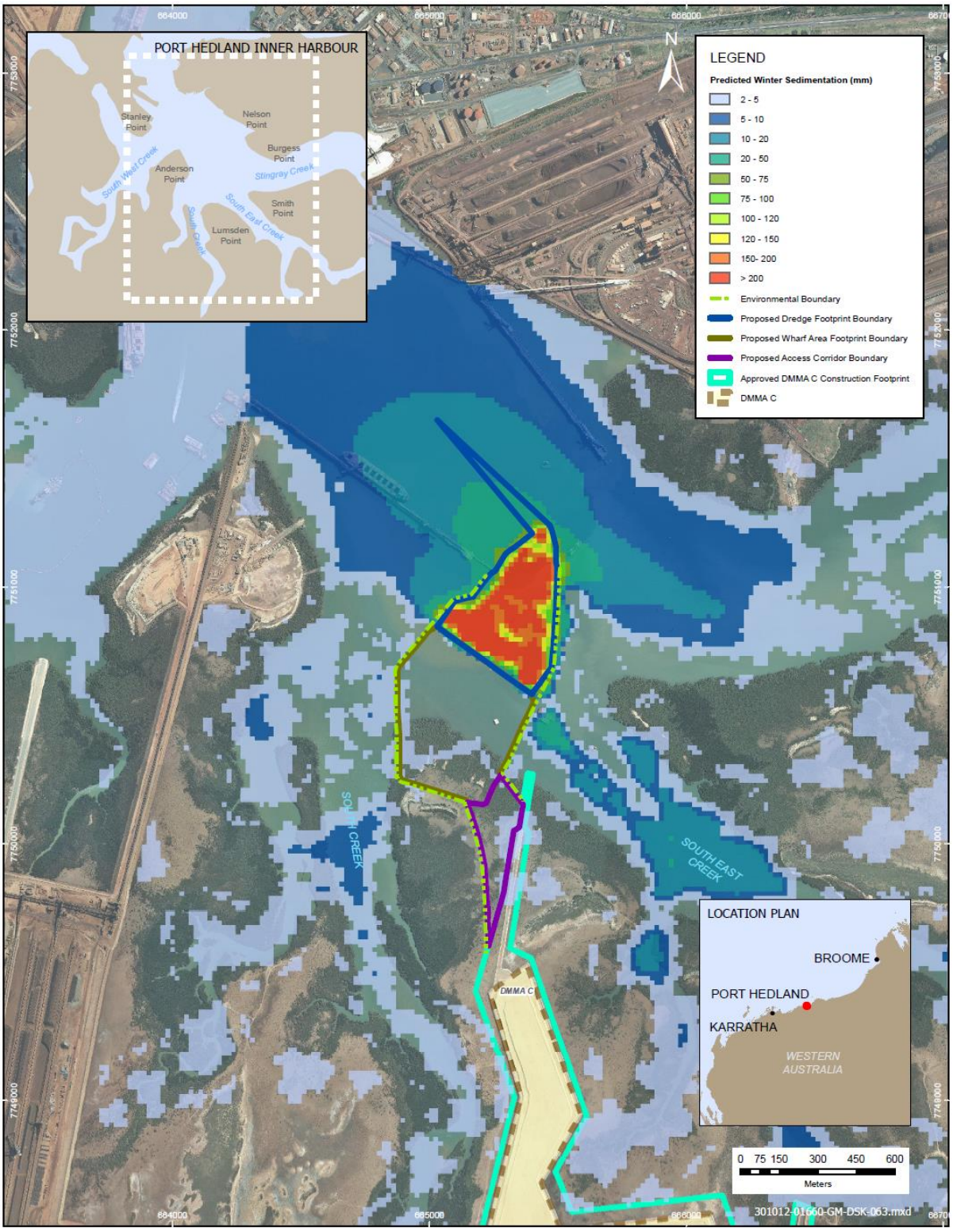


Figure 24: Total sedimentation after completion of dredging in the inner harbour: Winter scenario

Mangroves

Mangroves have adapted to survive in brackish, anoxic environments by developing vertical roots that extend above the soil surface. These roots help the absorption of oxygen for respiration. Mangroves inhabit sedimentary environments and promote sedimentation by reducing water movement. Burial by increased sedimentation can have deleterious impacts. In a review of the existing scientific literature, Ellison (1983) reported that most mangroves could tolerate sedimentation rates ranging from less than 5 cm to 10 cm per year. Burial of the aerial roots in 10 cm or more of sediment was generally lethal, although substantial differences existed among species.

Tolerance limits provided by DHI (DHI 2010) as part of the Wheatstone project define a zone of influence, allowing up to 50 mm of sedimentation (over several months) with partial mortality predicted where sedimentation exceeds 50 mm.

Monitoring of mangrove communities during dredging activities within Port Hedland harbour has found that mangrove communities have not been affected by increases in sedimentation. During a 15-month dredging program in South West Creek, sedimentation levels were found to increase by up to 24 mm in intertidal areas dominated by mangroves. Mangrove health investigations undertaken every three months did not identify any deterioration in health during this period.

Most of the inner harbour mangroves are expected to experience less than 2 mm of consolidated total seabed thickness change during dredging, other than localised 5 mm to 10 mm changes in the mangroves immediately adjacent to the Harriet Point berths. It is therefore highly unlikely that mangrove communities located outside the Lumsden Point General Cargo Facility development footprint will be affected and no indirect and irreversible loss of coastal intertidal BPPH is predicted to occur due to sedimentation.

On this basis, no mangroves will be impacted by sedimentation outside the ZoHI.

Other BPPs

Patches of coral, macroalgae and turfing algae within the inner harbour are likely to experience sedimentation of up to 20 mm during the course of the dredging activities. Sedimentation levels previously predicted for the Stingray Creek Cyclone Mooring Facility and South West Creek Dredging and Reclamation project were up to 22 mm in areas colonised by BPPs. Monitoring of BPPs during dredging activities within South West, Stingray and South East creeks recorded no adverse impacts or loss of BPPs during this period.

Given that sedimentation levels outside of the Lumsden Point General Cargo Facility footprint are predicted to be similar to those levels predicted for previous dredging projects, no impacts to other BPPs are predicted particularly given the planned short duration of this dredging program.

6.4.5 Hydrocarbon spills

Mangroves in the nearshore marine environment in the inner harbour constitute the BPPH most at risk from a hydrocarbon spill associated with the Lumsden Point General Cargo Facility. The surface of these plants are in regular contact with the water's surface and

therefore spilled hydrocarbons would be more likely to come into contact with them. The physical smothering of the pneumatophores causes damage to the mangals and the chemical composition of the hydrocarbon spilt may lead to leaf loss (Burns, Codi et al. 1999). Mangroves can also be killed through the toxicity of substances in the oil, especially lower-molecular-weight aromatic compounds, which damage cell membranes in the subsurface roots. This in turn impairs the normal salt exclusion process, and the resulting influx of salt is a source of stress to the plants (Burns, Codi et al. 1999).

6.5 Management of impacts

6.5.1 Direct impacts: physical removal

The dredge vessel will use an onboard GPS system to define the footprint boundary. A record track will be maintained and hydrographic surveys undertaken throughout the dredge program to ensure all disturbance activities are undertaken within the Lumsden Point General Cargo Facility footprint.

All dredging activities will be limited to the Lumsden Point General Cargo Facility dredge footprint.

6.5.2 Indirect impacts

The management of potential water quality impacts on BPP will be via the CDMP (Appendix 1) through, in summary:

- installing a satellite-based vessel monitoring system on the dredge and track plot analysis to ensure maximum efficiency of the dredging effort and that no dredging occurs outside the required area;
- maintaining currency of calibration of hydrographic survey systems onboard the dredge; and
- monitoring weather and sea conditions during dredging.

The PHPA will implement a mangrove health and BPP health monitoring program if turbidity and/or sedimentation rates exceed the adopted trigger levels described in the CDMP (Appendix 1) during dredging.

6.5.3 Predicted outcome

The following BPPs and BPPH will be directly removed within the proposed disturbance footprint during dredging:

- mangroves – 13.88 ha; and
- bare substrate – 8.34 ha.

No impacts are predicted to occur to BPPH outside the Lumsden Point General Cargo Facility footprint. Existing and potential environmental values through the Inner Harbour will be protected, including the environmental values and environmental quality objectives set by the Department of Environment (2006) for Pilbara coastal waters.

7. IMPACT ASSESSMENT AND MANAGEMENT - OTHER FACTORS

A range of additional environmental factors have the potential to be impacted by the Lumsden Point General Cargo Facility but are considered as readily manageable and are collectively assessed below. Table 16 presents information relevant to the assessment of impacts associated with these other factors and includes a summary of the existing environment, potential impact mechanisms, impacts, proposed management controls and predicted environmental outcomes.

Table 16: Impact Assessment - Other Factors

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
Terrestrial Flora and Fauna: **Vegetation**: • High habitat value of mangrove and intertidal areas • Open ground provides habitat for foraging marine/aquatic migratory waders **Fauna**: • 2 endangered and 2 vulnerable species • 47 migratory-listed bird species • and38 fauna species protected under EPBC Act may potentially occur in the study area • 5 species of	• Direct loss of vegetation as a result of clearing for construction • Loss of Priority Flora from clearing native vegetation • Direct loss of fauna habitat as a result of clearing for construction, as well as the potential to disrupt existing fauna linkages • Individual fauna deaths or injury as a result of vehicles or earthmoving equipment	Before mobilisation and during construction operations: • workforce management including briefings and instructions regarding clearing/disturbance procedures in environmental awareness training; • construction workforce and vehicle movement will be limited to designated areas; • speed restrictions, driver awareness and removal of road kill shall be enforced to minimise potential impacts arising from vehicular movement; • noise emissions and use of lighting during construction shall be minimised where practicable; and • design night-lighting so as to not shine directly onto mangrove habitats (low-pressure sodium vapour lamps are recommended). During dredging operations: • artificial lighting shall be reduced to the minimum required for safe operations; and • outside artificial lighting on vessels will be kept	• Loss of mangrove and intertidal habitat limited to areas discussed within the BPPH assessment • The vegetation communities and fauna habitats recorded are not considered of conservation significance and are isolated and segregated from the local area due to existing infrastructure and disturbances. • No significant impacts on the migratory bird species recorded • Light emissions from the dredging operations and construction activities have the potential to attract seabirds and extend their foraging time through the night. However, these activities are not expected to increase light emissions or add to total light emissions currently experienced within the Port

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
conservation significance recorded in most recent survey (WorleyParsons 2013a)		to a minimum and lighting should be switched off when not in use and automatic timers/sensors installed where possible.	
Marine Fauna • The EPBC Act Protected Matters report generated for the project area identified nine marine conservation significant fauna species that may potentially occur within a 10 km radius of the project area (WorleyParsons 2013a). • Of the listed species, flat back turtles and juvenile green turtles have been recorded using the waters of the harbour and the	• Turtles and other marine fauna are vulnerable to boat strike while surfacing to breathe or as a startle response to dredging noise or visual cues.	• Procedures for marine fauna interaction shall be developed for vessels to reduce the potential impacts to marine fauna. • Prior to the commencement of operations each day, a 300 m radius around the worksite will be inspected for the presence of turtles and marine mammals. • If any turtles, cetaceans or dugongs are sighted in the monitoring zone, dredging activities must not start in the monitoring zone until 15 minutes after the last marine mammal/turtle is observed to leave the monitoring zone or the dredge is to move to another area of the dredge site to maintain a minimum distance of 300 m between the vessel and any marine mammal/turtle identified during observations • All work-site personnel shall be inducted regarding the proper response to fauna interaction	• The likelihood of vessel strike inside the harbour will be minimised by following the controls outlined. • The relatively low vessel speeds that are applied inside the harbour will minimise the risk of marine turtle injuries or fatalities from vessel strike • Nesting habitat for flat back turtles at Cemetery Beach, Pretty Pool and Cooke Point will be unaffected by the Lumsden Point General Cargo Facility • Port Hedland is not considered an important aggregation or feeding area for dugongs and no impacts to dugongs or other marine mammals are anticipated.

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
surrounding mangrove creeks for foraging. • Small numbers of dolphins and dugong may also occur in the Port Hedland area		• The Dredge Contractor shall appoint an individual on each vessel who is trained in faunal observation and distance estimation to be responsible for undertaking marine fauna observations • The construction workforce and all vessels will be limited to designated areas. • Recreational boating, fishing, diving, spear-fishing, fossicking, (i.e. collecting shells and any other biological or natural material e.g. animal bones) will be prohibited during the Lumsden Point General Cargo Facility.	
Underwater Noise:	• Marine noise from piling and construction related activities • Potential impacts on turtles possible include (permanent threshold shift) PTS, (temporary threshold shift) TTS or behavioral response. • Noise impacts on marine turtles is not well understood, however it is generally	• Visual observations for marine turtles, dugongs and dolphins must be undertaken to the extent of the exclusion zone for at least 15 minutes before the start of and during piling activities. • Soft 'fairy taps' start procedures: as far as practical, piling activities must be initiated at the soft 'fairy taps' start level and then built up to full impact force. The soft 'fairy taps' start procedures may only begin if no marine turtles, dugongs or dolphins have been sighted within the exclusion zone during the pre-start-up visual	• The Port Hedland harbour is a heavily utilised port in relation to shipping movements, maintenance dredging to maintain navigable depths and construction and maintenance of berth infrastructure such that ambient underwater noise is already high. • It is possible, although highly unlikely that some animals may experience TTS if present close to the Lumsden Point General Cargo Facility during piling and

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
	accepted that turtles are less susceptible to marine noise compared to dolphins or whales.	observations. • Prior to the commencement of operations each day, a 300 m radius around the worksite will be inspected for the presence of turtles and marine mammals. • Equipment and vessels shall operate in accordance with appropriate industry and equipment standards including specifications for noise levels. Regular maintenance will be conducted to the manufacturer's specifications. Equipment covers, mufflers and other noise suppression equipment shall also be maintained and in good working order at all times. • Dredging and piling activities will be ceased if a significant marine mammal or reptile is sighted within the 'monitoring zone' of 300 m radius around the dredge or piling barge. • The use of thrusters and excessively noisy equipment will be avoided wherever practicable and engines, thrusters and auxiliary plant will not be left in 'stand by' or 'running' mode unnecessarily	construction activities. Few sedentary animals are expected to live in close proximity of the piling activity due to lack of significant benthic habitat.
Light	• Turtle hatchlings use lighting	• Where practicable, vessel loading and unloading	• The Port Hedland harbor is a heavily

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
	cues when they hatch and move down the beach to the water's edge. • Some forms of artificial lighting have been found to disorientate hatchlings and reduce their ability to access the sea following hatching. • Altered underwater light conditions in inshore waters may also change the levels of predation on turtle hatchlings, by attracting fish and other predators	in nearshore areas shall be conducted during daylight hours. Where this is not practicable, artificial lighting shall be reduced to the minimum required for safe operations. • Outside artificial lighting on vessels will be kept to a minimum (i.e. navigational lights and where safety dictates necessary deck lighting). Lighting should be switched off when not in use and automatic timers/sensors installed where possible. • Only necessary artificial lights shall be used. 'Unnecessary lighting' includes lighting in unused areas, decorative lighting or lighting that is brighter than needed.	utilised port that operates 24 hours/day such that ambient underwater light is already high. • Light generated by the project is unlikely to significantly alter the current light regime within the Port • The impacts associated with disorientation of turtle hatchlings are unlikely given the large distance between the dredge footprint and marine turtle nesting beaches.
Introduced Marine Species	• Non-native species (although no IMS) have been recorded in Port Hedland (Huisman et al 2008), • Studies were undertaken for the PHPA in 2010 to identify potentially introduced marine organisms within the Port and South West Creek near the	• Comply with Department of Agriculture requirements, state and federal legislation and particular provisions presented in this referral for dredges. • Any vessels coming to Port Hedland for the Lumsden Point General Cargo Facility from other Australian locations that carry ballast or entrained water are required to have the risk status of that water assessed, considering the	• Monitoring and surveillance of the dredge vessel and barges in accordance with Department of Agriculture and the PHPA's quarantine requirements will minimise the likelihood of any IMS being introduced.

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
	proposed dredge footprint (Oceanica 2010; WorleyParsons 2010a) • Biofouling surveys inside South West Creek were undertaken by deploying biofouling collectors at four locations for three months. Twenty-six biofouling taxa were recorded, seven of which were possibly introduced but none were considered high impact or invasive species of concern.	location of uptake and time of year, and to manage the water in accordance with the requirements of the National System for the Prevention and Management of Marine Pest Incursions, if it is deemed to be high risk. • Any vessels coming to Port Hedland for the Lumsden Point General Cargo Facility from overseas or domestically should be subject to a biofouling risk assessment following guidance within the *National Biofouling Management Guidance for Non-Trading Vessels* document. Vessels assessed as posing a risk should be inspected to ensure they are free of biofouling and preferably dry-docked for cleaning and repair/renewal of the antifouling system immediately before departure for Australia. • The PHPA routine IMS monitoring program undertaken by the DoF studies areas of concern within the Port. • All areas where mud and sediments can collect, including anchor and chain lockers and hoppers, should be inspected and cleaned before a vessel's departure for Port Hedland. Anchor chains, cables, and other gear that has been	

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
		deployed overboard should also be inspected and cleaned of any attached or entangled marine growth. These procedures should be repeated before departure from Port Hedland to prevent translocation of species away from this region.	
Coastal Processes	• Potential changes in hydrodynamic conditions caused by dredging and reclamation	• No additional controls proposed for this factor	• Current velocity changes within the existing Inner Harbour channel, turning basin between Anderson Point and Nelson Point, and the existing jetties near the project site including Anderson Point Berth 3, are negligible after development. • Changes in water-level conditions and inundation are predicted to be negligible.
Indigenous Heritage • The Lumsden Point General Cargo Facility is situated within the WC 99/003 Kariyarra Native Title Claim (the Kariyarra).	• One registered Aboriginal heritage site, site ID 22874 (Marapikurrinya Yintha) was identified in the dredge area and disturbance of this site cannot be avoided.	• Ethnographic and archaeological surveys have previously been conducted over the project footprint with members of the Marapikurrinya. • The PHPA is aware of the location of each of the heritage sites and where possible has undertaken careful planning and engineering solutions to avoid them.	• The PHPA is aware of its obligations under the Aboriginal Heritage Act 1972. In recognition of these obligations, the PHPA has a policy of conducting thorough ethnographic and archaeological heritage surveys before any ground disturbance activities begin. • The PHPA intends to seek ministerial

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
Marapikurrinya Pty Ltd (MPL) manages the conduct of Aboriginal heritage surveys for the Marapikurrinya family group on behalf of the Kariyarra native title claimants for the Port Hedland area.		• The PHPA will provide MPL with a continued right of access within this registered site where practical for health and safety reasons • The PHPA meets with MPL on a quarterly basis to discuss matters relating to Aboriginal cultural heritage and cultural impact assessment with the port. • The PHPA will undertake a project specific set of consultations with MPL in line with its Port Heritage and Collaboration Agreement with MPL.	approval under Section 18 of the Aboriginal Heritage Act 1972 to enable construction of infrastructure within the project footprint for the purpose of transport, storage, import and export of general cargo • On 1 December 2011 the PHPA received ministerial consent under Section 18 of the Aboriginal Heritage Act 1972 to construct DMMA B North. Any construction activities would be undertaken in accordance with the PHPA's approved Cultural heritage management plan for the DMMA B North area. • The PHPA is committed to on-going consultation with the MPL and to developing the Lumsden Point General Cargo Facility in accordance with the requirements of the Aboriginal Heritage Act 1972.
Terrestrial Noise and Vibration	• The key sources of potential offsite noise emissions are associated with piling	• Construction and dredging noise will be managed in accordance with existing procedures that have been applied in other recent expansion	• Offsite noise emissions from the proposal are not expected to be significant.

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
	activities during construction of the marine structures and operation of the cutter suction dredge.	projects in the Port Hedland. • The construction work and dredging activity will be carried out in accordance with the Environmental Protection (Noise) Regulations 1997 and the control of noise practices set out in Section 6 of Australian Standard 2436-1981 *Guide to noise control on construction, maintenance and demolition sites*. • This will include developing a project-specific Construction noise management plan (CNMP) in accordance with the Environmental Protection (Noise) Regulations 1997 with approval of the CNMP by the Town of Port Hedland. • The equipment used for the construction will be the quietest reasonably available. • Regular monitoring and maintenance of plant and equipment will be undertaken so that it remains in good working condition and noise emissions are kept to a minimum. • All equipment will be switched off when not in use. • All employees and contractors will be made aware of the need to minimise noise.	

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
Construction Air Quality and Greenhouse Gases	• An estimated volume of two million cubic metres of dredge material to be disposed of onshore, and has the potential to generate significant volumes of fine material, i.e. dust. • Emissions associated with fuel combustion from the operation of construction machinery and the exhaust emissions of marine vessels	Before mobilisation and during construction: • staff induction program to ensure all employees are made aware of the need to minimise dust generation; • regular watering of unsealed roads, exposed surfaces, active construction areas and stockpiles; • minimisation of traffic on unsealed roads; • re-vegetation and establishment of groundcover; • general housekeeping practices to ensure that there is no accumulation of waste materials within the construction site that may generate dust; • restriction of vehicle movements and vehicle speeds to reduce gaseous and dust emissions; • regular monitoring and maintenance of plant and equipment so that it remains in good working condition and gaseous emissions are kept to a minimum; and • all equipment will be switched off when not in use.	• Given the fine material will be placed into existing or approved DMMAs, any dust impacts associated with these areas will be managed under each of their respective Ministerial Statement • Other gaseous emissions such as NOx and SOx, particulates (PM10) and volatile organic compounds (VOCs) are expected to be minimal during the Lumsden Point General Cargo Facility construction and operation and only associated with fuel combustion from the operation of construction machinery and the exhaust emissions of marine vessels. • Emissions of VOCs due to combustion and evaporation during welding works, as well as evaporation from paints and solvents used onsite, are likely to be in small quantities and localised in effect

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
Operations Air Quality	• Dust generated from operations	• All activities licenced and managed by Part V licence • No bulk loading infrastructure proposed • Part V and Ambient Air Quality Network in place	• Dust emissions from operations are not expected to be significant.
Acid Sulfate Soils	• The potential for ASS was found in a small number (three) of tested samples collected from surface sediments.	• No active ASS management measures are required as excess ANC within the Red Beds is likely to be sufficient to neutralise any excess acidity generated by the near surface marine sediments • A preliminary ASSMP has been developed to support further characterisation of ASS within the proposed development footprint, management during construction and provision of contingency measures in the event that change management is required.	• Assessment of sediment quality and characterisation of ASS provides a high level of confidence that sediments are not ASS and will not require further management once disposed in the DMMA.
Hydrocarbons and Chemicals	Accidental spills resulting from : • Dredging activities that require the use of hydrocarbons e.g. Diesel and smaller amounts of lubricating oil and grease for dredging equipment.	• Hydrocarbon spills will be managed in accordance with the requirements of the PHPA's *Marine Pollution Management Plan.* • Dredge vessels: tanks and machinery shall be equipped with measurement and overflow protection (i.e. flow and level meters, relief valves, overflow protection valves and	• The risk of a large spill is small as the project is unlikely to require significant volumes of hydrocarbons to be stored onsite • Regular maintenance and systematic inspection of vessels plant and equipment by the dredge and

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
	• Land-based activities including construction of the wharf area and access corridor that may result in a minor hydrocarbon spillage from plant and equipment.	emergency shut-off). • Land-based plant and equipment shall be appropriately maintained and serviced in accordance with industry standards. • Industry standards, port authority and pollution prevention regulations shall be adhered to during: – refuelling; – transfer; – storage; and – handling of hazardous materials (e.g. bunding, level gauges, overflow protection, drainage systems and hardstands). • Hydrocarbons (including hydrocarbon wastes) shall be stored in appropriately labelled drums or tanks and in bunded areas that can contain 110% of material stored within. • Equipment will be designed and operated to prevent spills and leaks through the provision of in-built safeguards such as relief valves, overflow protection, and automatic and manual shut-down systems.	construction contractor with particular attention to hydrocarbon storage areas and bunding will reduce the likelihood of equipment failure, spills and leaks.

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
		• Controlled wastes shall be managed as per the Environmental Protection (Controlled Waste) Regulations 2004 (WA). • Establish comprehensive vessel refuelling procedures to avoid or reduce the possibility of a release include as a minimum the requirements for: – adhering to all port authority and pollution regulations; – refuelling during daylight hours where possible, depending on sea conditions; – refuelling within established safety boundaries and during weather/sea/visibility conditions that will minimise potential release risk; – training personnel involved with refuelling or fuel transfer in their roles, functions and responsibility, including emergency response; – maintaining open communication channels; – deploying spill prevention systems in accordance with established procedures and regulatory requirements; and – maintaining emergency response	

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
		equipment to ensure that it is readily available. • All personnel will be familiar with the use of oil spill clean-up kits and dispose of waste in the prescribed manner.	
Waste Management	Solid and liquid wastes that may be generated by the Lumsden Point General Cargo Facility include: • packaging material (plastic wrapping, pallets etc.); • concrete; • scrap metal; • waste oil, hydrocarbons and hazardous materials (see Section 6.4.4); • recyclable materials (paper, cardboard, aluminium); • general food packaging and scraps; and • domestic sewage.	• Controlled wastes shall be managed as per the Environmental Protection (Controlled Waste) Regulations 2004 (WA). • Waste from vessels operating with the Harbour will be managed in accordance with the PR-E11 PHPA Guidelines for Ship Waste Discharge within Port Limits. • Waste management requirements shall be communicated to personnel (i.e. through inductions, pre-starts and/or Job Hazard Analyses [JHAs]). • Communication systems on vessels shall be capable of handling the volumes generated and be maintained regularly so they are efficient and fully operational at all times. • Solid and liquid wastes and hazardous materials shall be stored in appropriately labelled drums or tanks.	• Regular maintenance and systematic inspection of vessels plant and equipment and storage areas by the dredge and construction contractor with particular attention to hydrocarbon storage areas and bunding will reduce the likelihood of equipment failure, spills and leaks.

Factor/Existing Conditions	Potential Impacts	Proposed Management Controls	Predicted Outcome
		• Hazardous substances handling is to be carried out by suitably trained personnel only. • Hazardous material storage areas shall be engineered and designed to handle the volumes and operating conditions (both normal and upset conditions) specifically required for each substance, including product identification, transportation, storage, control and loss prevention (e.g. bunding and drainage). • Incompatible products will not be stored together. • Empty liquid waste containers shall be segregated from other wastes and stored in designated areas.	

8. PROPONENT'S ENVIRONMENTAL MANAGEMENT COMMITMENTS

The PHPA is committed to achieving or exceeding a level of environmental management performance consistent with national and international standards and statutory obligations. The Lumsden Point General Cargo Facility will be conducted in a manner that will minimise impacts on the surrounding environment.

8.1 Proponent responsibilities

The PHPA takes a responsible and pro-active response to the environmental management of its activities. To this end its environmental responsibilities with respect to the Lumsden Point General Cargo Facility will include:

- obtaining relevant approvals and permits to undertake the works;
- appointment and management of a suitably qualified dredging contractor;
- retention of the PHPA's Dredging Manager with 30 years international experience;
- advising the dredging contractor of significant environmental issues;
- ensuring the dredging contractor meets the obligations outlined in the CDMP; and
- undertaking monitoring and reporting of the effects of dredging activities on significant environmental receptors.

8.2 Dredging contractor responsibilities

The environmental management responsibilities of the appointed dredging contractor include:

- complying with the relevant legislation, regulations and approval conditions;
- complying with the requirements of the CDMP;
- complying with the PHPA requirements, including Marine Oil Pollution Management Plan;
- implementing environmental management strategies and measures and specific marine monitoring programs as specified within this referral document and appendices;
- appointing a nominated Environmental Officer throughout the project;
- ensuring dredging equipment is in good condition and properly maintained for the duration of the works;
- taking all reasonable measures to protect the environment in and around the project areas and mitigating and/or protecting the environment against impacts of the project resulting from mobilisation of potential contaminants, increased turbidity and sedimentation, storage and handling of hydrocarbons and chemicals, waste

management, noise (underwater/terrestrial sources), physical presence of dredge vessel and introduced marine species; and

- undertaking disposal off-site of all rubbish, debris, scrap metals and redundant gear, including implementation of a recycling program to minimise disposal to landfill.

In the event of any non-compliance with the approved Lumsden Point General Cargo Facility environmental management plans or a breach of legislative requirements in respect to the environment, the dredging contractor is obliged to report the type and extent of such non-conformance to the PHPA. Dredge operations may be suspended until any and all deficiencies are addressed and corrected by the dredging contractor.

9. STAKEHOLDER CONSULTATION

9.1 Overview

Stakeholder and community consultation is an important element of the environmental assessment process. As part of the consultation program, the PHPA acknowledges that members of the community, key stakeholders and decision-making authorities require opportunities to learn about the Lumsden Point General Cargo Facility and its potential impacts in order to make informed comments and raise relevant issues and concerns. The stakeholder and community consultation program was therefore designed to capture, consider and respond to feedback as part of undertaking a robust environmental impact assessment process.

The objectives of the consultation program were to provide an open and transparent forum, at an early stage of the Lumsden Point General Cargo Facility to:

- Identify key stakeholders and community representatives that have a direct interest or stake in the project;
- Provide public access to relevant information about the project so that individuals, groups and organisations may be informed about the project;
- Provide opportunities for stakeholders to identify key issues and concerns for consideration in the environmental review process; and
- Minimise social and environmental impacts associated with the construction and future operation of the proposed Lumsden Point General Cargo Facility.

9.2 Stakeholder and Community Consultation Program

The PHPA has undertaken consultation in Perth, Port Hedland and Karratha since August 2012. A breakdown of consultation events is listed below:

- Consultation meeting with representatives from the Office of the Environmental Protection Authority, the Department of State Development, the Department of Transport, the Department of Treasury and the Department of Commerce in Perth on 3 August 2012;
- Consultation meeting via telephone with a representative from the Office of the Environmental Protection Authority (OEPA) on 25 September 2012;
- Consultation meeting with representatives from the Office of the Environmental Protection Authority and the Department of Commerce in Perth in October 2012;
- Stakeholder and Community workshop held at the Port Hedland Port Authority, Port Hedland Office on 5 December 2012;
- Individual stakeholder meetings held in Port Hedland on 5 December 2012;

- Consultation meeting with representatives from the Environmental Protection Authority and Office of the Environmental Protection Authority (OEPA) in Perth on 16 August 2013;
- Consultation with representatives of the Department of Fisheries via phone and email correspondence in August and September 2013; and
- Consultation meeting with representatives of the Office of Environment Regulation in Karratha on 24 September 2013.

In addition, PHPA has undertaken:

- Consultation with the traditional owners to minimise the disturbance to Aboriginal heritage sites in accordance with the *Aboriginal Heritage Act 1972;*
- Consultation with port users at fortnightly interface meetings; and
- Consultation with representatives of the Department of Commerce at monthly meetings.

9.2.1 Stakeholder and Community Information Session

The PHPA held an information session for key stakeholders and the community in December 2012 (Figure 25). Port Hedland based stakeholders were formally invited by letter and advertisements were also placed in the Pilbara Echo and North West Telegraph newspapers for a number of weeks (Figure 25). The information provided to all stakeholders at briefing meetings and the information evening included:

- a brief history of the project;
- a summary of a demands study on port users , showing justification for why the project needs to be developed;
- the objectives of the new facility;
- a summary of the alternatives considered;
- a summary of the proposed dredging program;
- a summary of the preliminary investigations and planning already undertaken, and future investigations planned before construction;
- the planned project schedule; and
- an opportunity for questions and comments.

Figure 25: Stakeholder information evening held by the PHPA in 2012

9.3 Stakeholder List

The following parties were identified as key stakeholders with a significant interest in the Lumsden Point General Cargo Facility and were invited to take part in the consultation process.

State government:

- Office of the Environmental Protection Authority;
- Department of Environment Regulation;
- Department of Parks and Wildlife;
- Department of Fisheries;
- Department of State Development;
- Department of Treasury;
- Department of Transport; and
- Department of Commerce.

Local government:

- Town of Port Hedland.

Community members/organisations:

- Care for Hedland Environmental Association;
- Port Hedland Industries Council
- Port Hedland Chamber of Commerce;
- Port Hedland Game Fishing Club;
- Port Hedland Progress Association; and

- Port Hedland Yachting Club.

Proponents:

- BHP Billiton;
- Fortescue Metals Group Limited;
- North West Infrastructure;
- Roy Hill; and
- other port users.

9.4 Outcomes of Consultation

The EPA has been consulted over a series of meetings since July 2010. Initial queries from the PHPA covered the level of assessment at which the EPA expected the Lumsden Point General Cargo Facility to be set. Based on discussions with the EPA and accurate identification of impacts associated with the project, as well as on previous dredging projects undertaken adjacent to the proposed dredge footprint and their identified impacts, the PHPA suggests that the appropriate level of assessment would be 'Assessed on Proponent Information' and the PHPA would be supportive of this level of assessment.

All responses provided during the consultation program were collated and considered in the preparation of this document. A summary of feedback received from stakeholders has been provided in Table 17 below.

Table 17: Comments raised by stakeholders and document reference where comments have been addressed

Stakeholder	Comments/Issues Raised	Refer to Document Section
OEPA	• Advised it is important that every opportunity to avoid and minimise loss of mangrove communities be demonstrated in line with EAG 3. • Need to identify what the direct and indirect impacts will be. • Inclusion of a robust Dredge Management Plan and Project Execution Plan. • Provided advice in relation to level of assessment and comments on draft documentation.	Referral Supporting Document, Section 1.6, Section 6 and Appendix 1.
DoF	• Noted that reference to AQIS in draft documentation should be the Department	Construction and Dredge Management Plan, Section 6.4.

Stakeholder	Comments/Issues Raised	Refer to Document Section
	of Agriculture. • Noted that the DoF guidelines for marine pest management should be considered. • Advised that the DoF is willing to help with any vessel risk assessments on behalf of the PHPA.	
Town of Port Hedland	• Had queries regarding the potential for collaboration on Design Guidelines for Wedgefield, and in relation to funding assistance with the Wedgefield local road network.	The PHPA will address these comments with the industry stakeholders directly. As such, they will not be addressed in this document
Care for Hedland Environmental Association	• Raised concerns regarding the capital dredging and removal of mangroves. • However noted that following the information session they were confident that the PHPA would follow best practice environmental standards. • Requested that a monitoring site be developed at the inshore coral reefs fringing the Spoil Bank and Cemetery Beach to Pretty Pool.	The PHPA has committed to implementing a Construction and Dredge Management Plan to ensure there are not indirect impacts on BPPH as a result of the project. Refer to Section 7 for details of the monitoring programs.

9.5 On-Going Consultation

The PHPA will conduct on-going consultation with key stakeholders at relevant project milestones throughout the Project approvals assessment phase and beyond. Consultation with Proponents is currently held on a weekly basis at industry interface meetings. The PHPA also provides an 'open door' policy to community organisations who seek to further understand existing and planned projects being undertaken by the port.

10. CONCLUSION

Through the successful implementation of similar dredging projects in Port Hedland in the past (i.e. South West Creek Dredging and Reclamation Project and Stingray Creek Cyclone Mooring Facility), the PHPA has demonstrated its commitment to comply with its environmental obligations and commitments.

The Lumsden Point General Cargo Facility construction and operation will be completed in accordance with the CDMP (Appendix 1).

Based on the information collated through the targeted environmental investigations and other supporting studies in the Port Hedland area, the PHPA considers that the Lumsden Point General Cargo Facility can be constructed and operated in accordance with the OEPA's guidance and intent in managing and minimising impacts to the environment and that formal assessment under the *Environmental Protection Act 1986* at "Assessed on Proponent Information" level would be suggested and supported.

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Appendix 1 - Construction and Dredge Management Plan

Appendix 2 - Sediment Quality Report

Appendix 3 - Benthic Habitat Survey

Appendix 4 - Plume Dispersion Modelling

Appendix 5 - Cumulative Impact Assessment

Appendix 6 - Nearshore Environmental Sampling Factual Report